

Species Diversity, 2006, 11, 99–135

On the Genus *Gomphodella* (Crustacea: Ostracoda: Limnocytheridae) with Descriptions of Three New Species from Australia and Redescription of the Type Species

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(Received 4 January 2005; Accepted 22 February 2006)

In the present paper three new species of the genus *Gomphodella* De Deckker, 1981 are described: *G. glomerosa* sp. nov., *G. hirsuta* sp. nov., and *G. yandii* sp. nov. Also, the type species of the genus, *G. maia* De Deckker, 1981, is redescribed and the generic diagnosis is revised. All the new species are characterized by little sexual dimorphism in the valve shape and by the absence of the posterior seta on the fourth antennular segment, features that clearly separate them from *G. maia*. All species were collected in Western Australia, the new ones in subterranean waters, and *G. maia* from a spring.

Key Words: Crustacea, Ostracoda, Limnocytheridae, *Gomphodella*, taxonomy, key, Australia, subterranean waters.

Introduction

Research on the Australian freshwater ostracod fauna dates back to the middle of the 19th century (King 1855), and since then approximately 130 Recent species have been described. They are all surface water inhabitants, of which almost 81% (105 species) belong to the family Cyprididae. Only the following seven representatives of the family Limnocytheridae are recorded from Australian inland aquifers (see Chapman 1914; Henry 1923; Hussainy 1969; De Deckker 1981a, b, 1982): *Gomphocythere australica* Hussainy, 1966, *Gomphodella maia* De Deckker, 1981; *Limnocythere aspera* Henry, 1923; *L. dorsosicula* De Deckker, 1982; *L. milta* De Deckker, 1982; *L. mowbayensis* Chapman, 1914; and *L. porphyretica* De Deckker, 1981. This is far below the expected number of Australian Limnocytheridae, because, until now, only a small part of this continent has been surveyed.

According to Martens (1995, 1996), the family Limnocytheridae is divided into two subfamilies: Limnocytherinae and Timiriaseviinae. The former subfamily is furthermore divided into three tribes (Martens 1996), mostly based on type of the hinge. It is doubtful whether the latter subfamily can similarly be subdivided (Martens 1995). The following 12 genera belong to the subfamily Timiriaseviinae (Colin and Danielopol 1980; Martens 1995): *Abrocythere* Zhao, 1987; *Afrocythere* Klie, 1935; *Cytheridella* Daday, 1905; *Elpidium* Müller, 1880; *Frambocythere* Colin, 1980; *Gomphocythere* Sars, 1924; *Gomphodella* De Deckker, 1981; *Kovalevskiella* Klein, 1963 (misspelled in Karanovic 2003a); *Metacypris* Brady and Robertson, 1870;

Rosacythere Colin, 1980; *Theriosynoecum* Branson, 1936; and *Timiriasevia* Maldelstam, 1947. Genera *Abrocythere*, *Frambocythere*, *Rosacythere*, *Theriosynoecum*, and *Timiriasevia* are only known as fossils, with the oldest record dating back to the Upper Triassic, and the youngest to the Miocene (see Colin and Danielopol 1980). The other seven timiriaseviine genera also have Recent species. *Afrocythere rostrata* Klie, 1935 is the only representative of its genus, being known from two localities in Guinea (Klie 1935). Another monospecific genus, *Gomphodella*, is known only from South Australia (De Deckker 1981a). The genus *Elpidium* has six species, all Recent, living in bromeliad cups in Central and South America. The genus *Gomphocythere* contains 15 living species, *Cytheridella* 10, and *Kovalevskiella* five, while *Metacypris* has two living representatives. Among living species of *Gomphocythere*, only *G. duffi* (Hornibrook, 1955), *G. australica* Hussainy, 1969, and *G. ortalii* Martens, 1993 are known outside Africa. The first two were described from New Zealand and Australia, respectively (Hornibrook 1955; Hussainy 1969), while the latter one is known from Israel (Martens 1993). The Recent species of *Cytheridella* are distributed in South America and Africa, and those of *Kovalevskiella* only in subterranean waters of Europe (mainly the Balkan Peninsula) and Central Asia (Karanovic 2003a), while *Metacypris cordata* Brady and Robertson, 1870 has a wide Holarctic distribution. In the last 50 years about 63 fossil species of *Gomphocythere* have been described from many Eurasian Mesozoic deposits. After several revisions, the major ones having been done by Pinto and Sanguinetti (1962) and Colin and Danielopol (1980), none of those 50 species now belong to *Gomphocythere*, but rather to some of the exclusively fossil genera of the subfamily Timiriaseviinae (the majority to *Theriosynoecum*). *Cytheridella* also has several fossil species. Monostori (1993) gave a short review of the fossils of *Cytheridella* recognised up to then and also described *C. buseri* Monostori, 1993 from Slovenia. Later on, Bhandari (1998) described another two species (*Cytheridella gujaratensis* Bhandari, 1998 and *C. govindani* Bhandari, 1998) from India. *Cytheridella* today has six fossil species, occurring throughout the Tertiary (from the Eocene) in shallow freshwaters of Eurasia. The genus *Kovalevskiella* has four fossil species, all from the Tertiary (Oligocene to Pliocene) freshwater deposits of Europe and Central Asia. Although *Metacypris* has only two living species, it has a very long fossil history (the oldest representatives dating from the Jurassic), with species described from almost all over the world.

This paper is a result of the recent increasing interest in research on the Western Australian subterranean waters. Most of the ostracod samples collected during these investigations contained Candoninae (Karanovic and Marmonier 2002, 2003; Karanovic 2003b); however, in a few of them were found the three limnocytherid species described in the present paper. In addition, several spring samples from Western Australia contained the type species of this genus, *Gomphodella maia*, which is here redescribed. This is the first finding since it was originally described by De Deckker (1981a).

Materials and Methods

Samples were collected with haul-nets (mesh size 250 or 350 μm) from groundwater monitoring bores (observation bores) and mineral exploration bores. Bores

are variously lined with steel or PVC pipes (the casing), usually 10–20 cm in diameter, that may be perforated at particular depths, or be open only at the bottom. Mineral exploration bores are unlined. The top may be securely capped or entirely open to the elements. All bores were located in groundwater calcrete deposits in the palaeodrainage system of the Western Shield region of Western Australia (Humphreys 1999, 2001). From springs, samples were collected with a hand-net, mesh size 250 μm , while interstitial samples were collected with Bou-Rouch pump.

Haul-nets are simple plankton nets of different sizes suitable for the bore, which can range from 30 to 180 mm in diameter. Weighed nets were lowered into the bore with a bottle screwed onto its distal part, then hauled up through the water column, usually a number of times. All samples were sorted while alive under a dissecting microscope and the ostracods were then fixed in 70% ethyl-alcohol and assigned a field number (prefix BES for Pilbara and Murchison samples, CW for Margaret River samples).

Ostracods were dissected in an equal mixture of distilled water and glycerol with fine entomological needles (mark 000). Dissected appendages and valves of some specimens were mounted in Faure's medium. The appendages of some specimens were mounted on slides in glycerol, while their valves are kept on micropalaeontological slides or in glass test-tubes in 70% alcohol. All non-dissected material is preserved in 70% ethyl-alcohol in glass test-tubes. Drawings were prepared using a drawing tube attachment on a Leica-DMLS microscope, with C-PLAN achromatic objectives. Several specimens of *Gomphodella maia* (from sample number 3 in the material list for this species) are deposited in the research laboratory of the tourist organization "Cave Work" (CW) for further ecological work. This organization manages several caves in Margaret River. A few specimens are deposited in the Royal Belgium Institute of Natural Sciences (RBINS), while the majority of the specimens (including the type specimens) are deposited in the Western Australian Museum (WAM).

For scanning electron microscopy (SEM), soft parts were taken from their valves and then dehydrated in a graded series of ethanol: 70%, 80%, 95%, and 100%. In each of the grades, the soft parts were left for about 15 minutes. The carapace was kept in 100% ethanol for only a few minutes. After that, the soft parts and carapace were mounted on an SEM stub using double-sided adhesive tape ("Scotch"). All samples were sputter-coated with gold and observed under a ZEISS FEG VPSEM microscope with in-lens detectors, at a working distance of between 2 and 6 mm and an accelerating voltage of between 2 and 5 kV.

In the systematic part of this paper the lengths of all segments were measured along the median plane, and length ratio are presented beginning with the proximal end. No abbreviations are used in the text and figures. For the morphology and terminology of the hemipenis, see Martens (1990).

Many bores, which were put in for hydrogeological work, mineral exploration, or water monitoring, have prefixes or suffixes of relevance only to that drilling program. These codes are cited in the material list for each species to aid specification of the location.

Systematics

Family **Limnocytheridae** Sars, 1925

Genus ***Gomphodella*** De Deckker, 1981

Revised diagnosis. Females with brood chamber. Valve surface covered with prominent warts, sometimes also ornamented with pits and ridges. Sieve pore canals present (Figs 92A, E, 93C). Hinge lophodont, left valve overlapping right one anteriorly and dorsally, right valve overlapping left one ventrally. Four muscle scars present. Antennula five- or six-segmented; fourth and fifth segments sometimes fused. Second segment of antennula without any seta posteriorly. Fusion zone between antennular aesthetasc and accompanying seta short. Antenna four-segmented, terminal segment with three claws. Exopodite of mandibula with three rays, palp four-segmented. Setae on penultimate and terminal segments of mandibular palp transformed into distally thick claws with bent, spine-like tips (Fig. 92F), and second segment of palp lacking seta on outer edge. Maxillular palp with incompletely divided segments. Females with two furcae, each consisting of two/three hirsute lobes and one/two furcal setae. Distal lobe of hemipenis prominent and articulated, triangular. Dorsal margin slightly curved, while ventral one extending into different shapes.

Type species. *Gomphodella maia* De Deckker, 1981.

Other species. *Gomphodella glomerosa* sp. nov., *G. hirsuta* sp. nov., and *G. yandii* sp. nov.

Gomphodella maia De Deckker, 1981
(Figs 1–21, 92A, B, 93B)

Gomphodella maia De Deckker, 1981a: 132, figs 26, 27.

Material examined. Fourteen females (one on slide, WAM C28408; three on SEM stub and others in alcohol, WAM C28409), Turners Spring (benthos/interstitial), Margaret River, Western Australia, Australia, 34°20'53"S 115°09'14"E, 27 February 2002, coll. S. Eberhard (CW 00 029). One male (on slide, WAM C28410) and several empty valves of males (WAM C28411), Turners Spring (benthos/interstitial), Margaret River, Western Australia, 34°20'53"S 115°09'14"E, 27 February 2002, coll. S. Eberhard (CW 00 033). Four females, Turners Spring (benthos/periphyton), Margaret River, Western Australia, 34°20'53"S 115°09'14"E, 27 February 2002, coll. S. Eberhard (CW 00 063).

Redescription. *Female.* Length of carapace ranging from 0.402 mm to 0.483. In dorsal view (Fig. 1), carapace triangular with greatest width in last third, width equalling 72.8% of length. Anterior end slightly cuneiform, posterior end widely rounded. Hinge lophodont and left valve overlapping right valve dorsally and caudally. In ventral view (Fig. 2), right valve overlapping left one. No ridges visible centrally. In lateral view (Figs 5–8), dorsal margin straight in middle, sloping evenly towards anterior and posterior ends. Greatest height situated around mid-length, equalling 53.6% of length. Both frontal and caudal margins almost equally wide. Ventral margin straight. Selvage developed and caudally inwardly displaced on both valves. Calcified inner lamella wider anteriorly, maximum width

equalling approximately 19.6% of carapace length. Fused zones developed and well recognizable on both valves, with several regular and uniformly long pore canals. Four adductor muscle scars present (Fig. 92B). Valves well calcified, densely ornamented with shallow pits (Fig. 92A). Carapace also covered with long, strong setae originating from small, cylindrical, and very densely arrayed warts.

Antennula (Fig. 11) six-segmented. First and second segments with no seta. Third segment with apical pappose seta anteriorly, seta reaching distal end of following segment. Fourth segment with two unequal setae anteriorly (pappose one reaching distal end of following segment, smooth one reaching end of terminal segment) and one pappose seta posteriorly (just exceeding distal end of penultimate segment). Fifth segment with three unequally long setae anteriorly, two of them pappose (shortest one reaching middle, medial one reaching distal end, and longest one exceeding distal end of terminal segment). Fifth segment also carrying one pappose seta posteriorly, this about twice as long as terminal segment. Terminal (sixth) segment with four setae, one or two of them aesthetascs, fused basally with one of two setae. Length/width ratio of fused part of seta and aesthetasc 2.00 : 1.00. Longer, free setae 1.80 and 1.20 times as long as terminal segment. Length ratio of five distal segments 4.50 : 1.40 : 1.00 : 1.70 : 2.50.

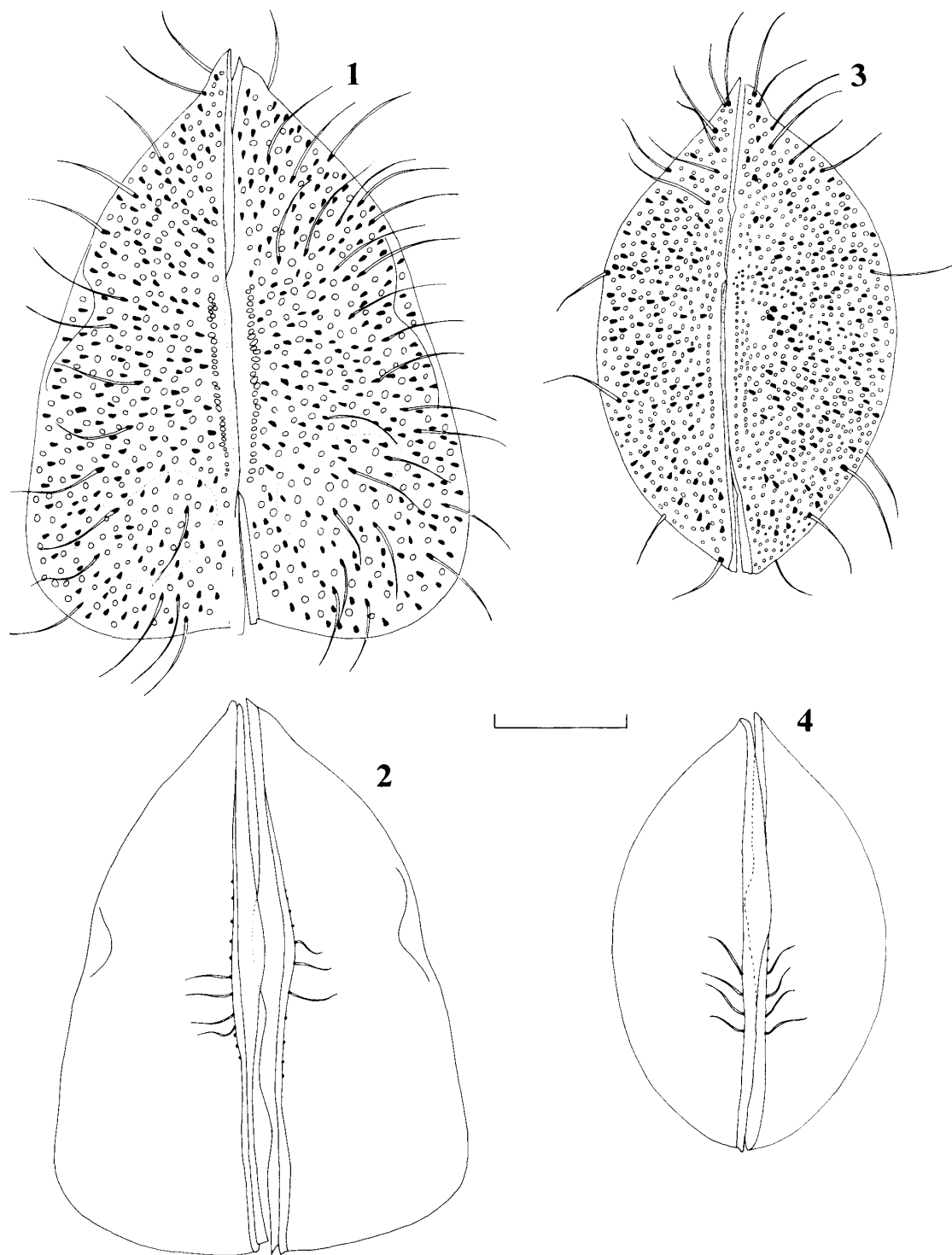
Antenna (Fig. 12) four-segmented. Exopodite reaching distal end of terminal claws. First segment without any seta, second segment armed posterodistally with one seta, this seta pappose and exceeding middle of penultimate segment. Third segment with two pappose setae and one aesthetasc posteromedially (latter as long as shorter seta), and also with one swollen pappose seta posterodistally and one very thin seta anteromedially, latter reaching distal end of third segment. Terminal segment with three equal, slightly curved claws. Length/width ratio of penultimate segment 5.00 : 1.00.

Mandibula (Figs 13, 93B) with eight teeth on coxa. Exopodite with three long, pappose rays. Palp four-segmented; first segment with two unequal setae on inner edge (one of them reaching distal end of penultimate segment, about twice length of second seta), outer edge without seta. Second segment with two setae on inner edge, both exceeding distal end of terminal segment, and no seta on outer edge. Penultimate segment with two setae on outer edge, these subequal in length and reaching distal end of terminal claws. Penultimate segment with one "simple seta" on inner edge, and one seta transformed into claw. Terminal segment with two claws. All mandibular claws on penultimate and terminal segments distally thickened with bent, spine-like tips.

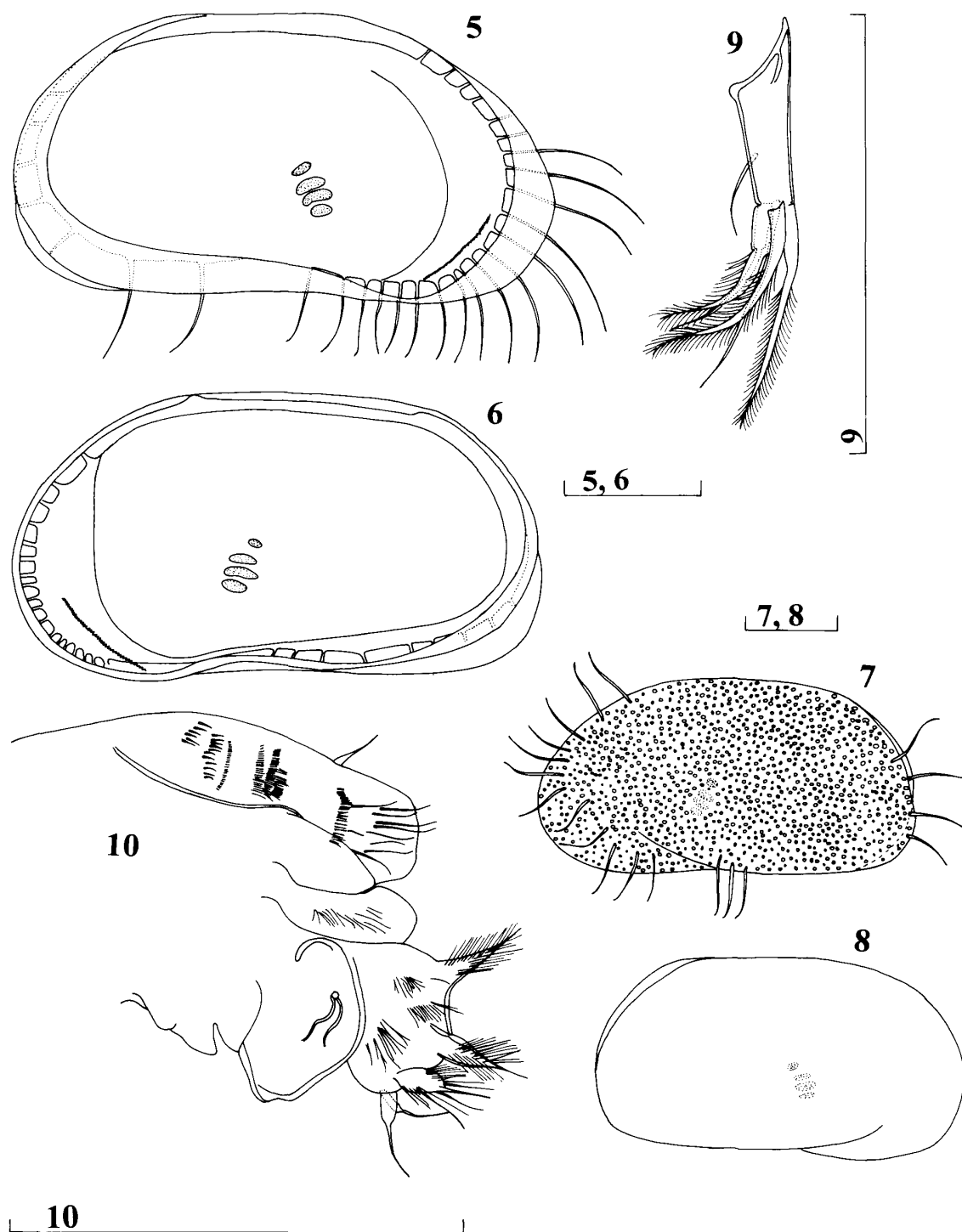
Maxillula with three elongated endites, each bearing four claw-like setae. Palp (Fig. 9) weakly sclerotized and incompletely segmented. First segment with four well developed setae (three of them pappose), and one much smaller seta inserted more proximally.

First walking leg with protopodite armed anteriorly with one proximal seta, one medial seta, and two distal setae, all pappose, and posteroproximally with one pappose seta. First endopodal segment with one pappose seta anterodistally (reaching middle of second segment). Claw smooth, 1.20 times as long as terminal segment. Length ratio of three endopodal segments 1.70 : 1.00 : 1.00.

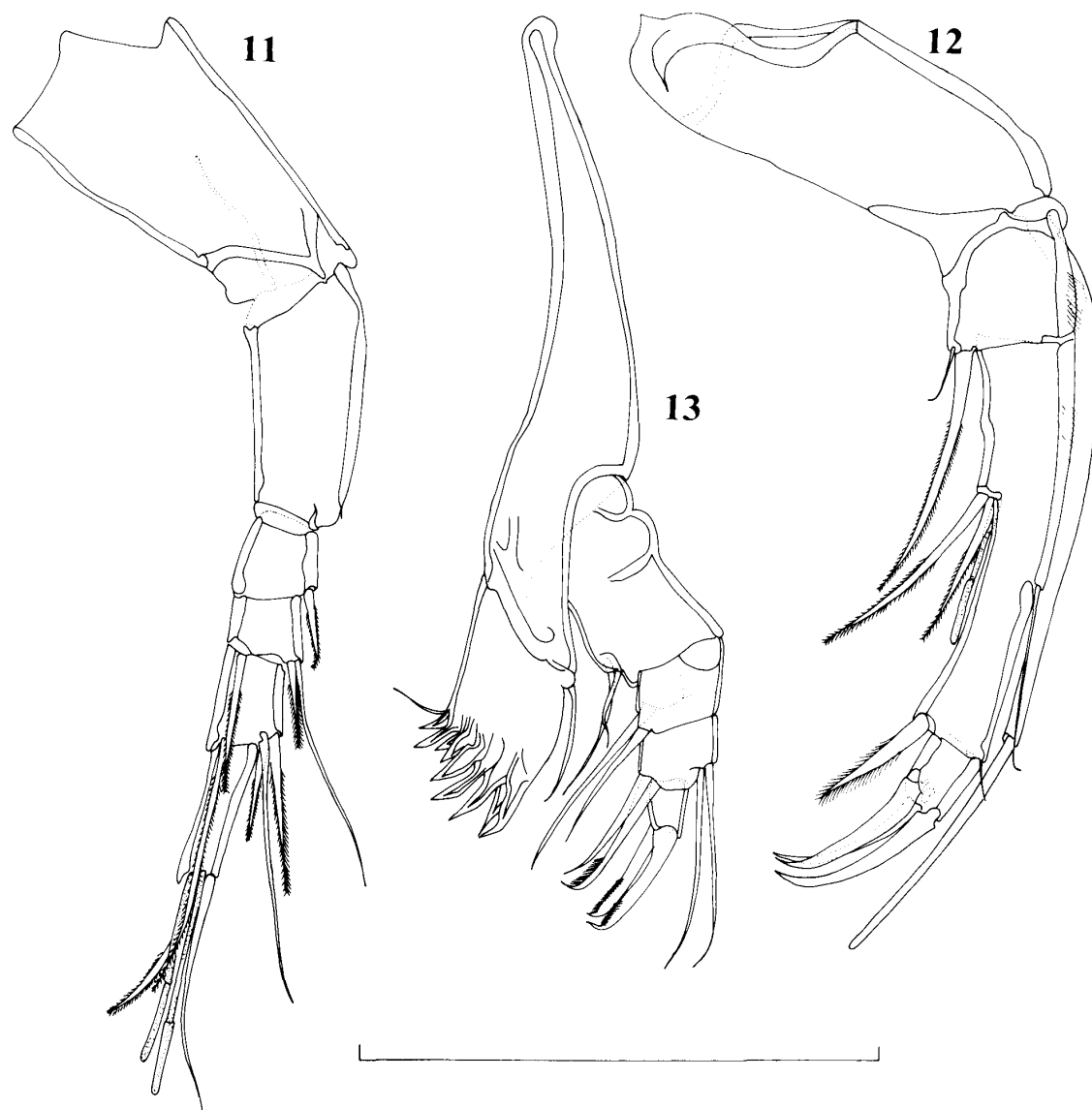
Second walking leg with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and posteroproximally with one pappose seta. First endopodal segment with one pappose seta anterodistally (reach-



Figs 1-4. *Gomphodella maia* De Deckker, 1981. 1, 2, Female (0.446 mm, WAM C28409); 3, male (0.379 mm, WAM C28411); 4, juvenile (0.336 mm, same lot). 1, 3, Carapace, dorsal view; 2, 4, carapace, ventral view. Scale=0.1 mm.



Figs 5–10. *Gomphodella maia* De Deckker, 1981, female (0.428 mm, WAM C28408). 5, Left valve, internal view; 6, right valve, internal view; 7, left valve, external view; 8, right valve external view; 9, maxillular palp; 10, end of body with furca and genital field. Scales=0.1 mm.



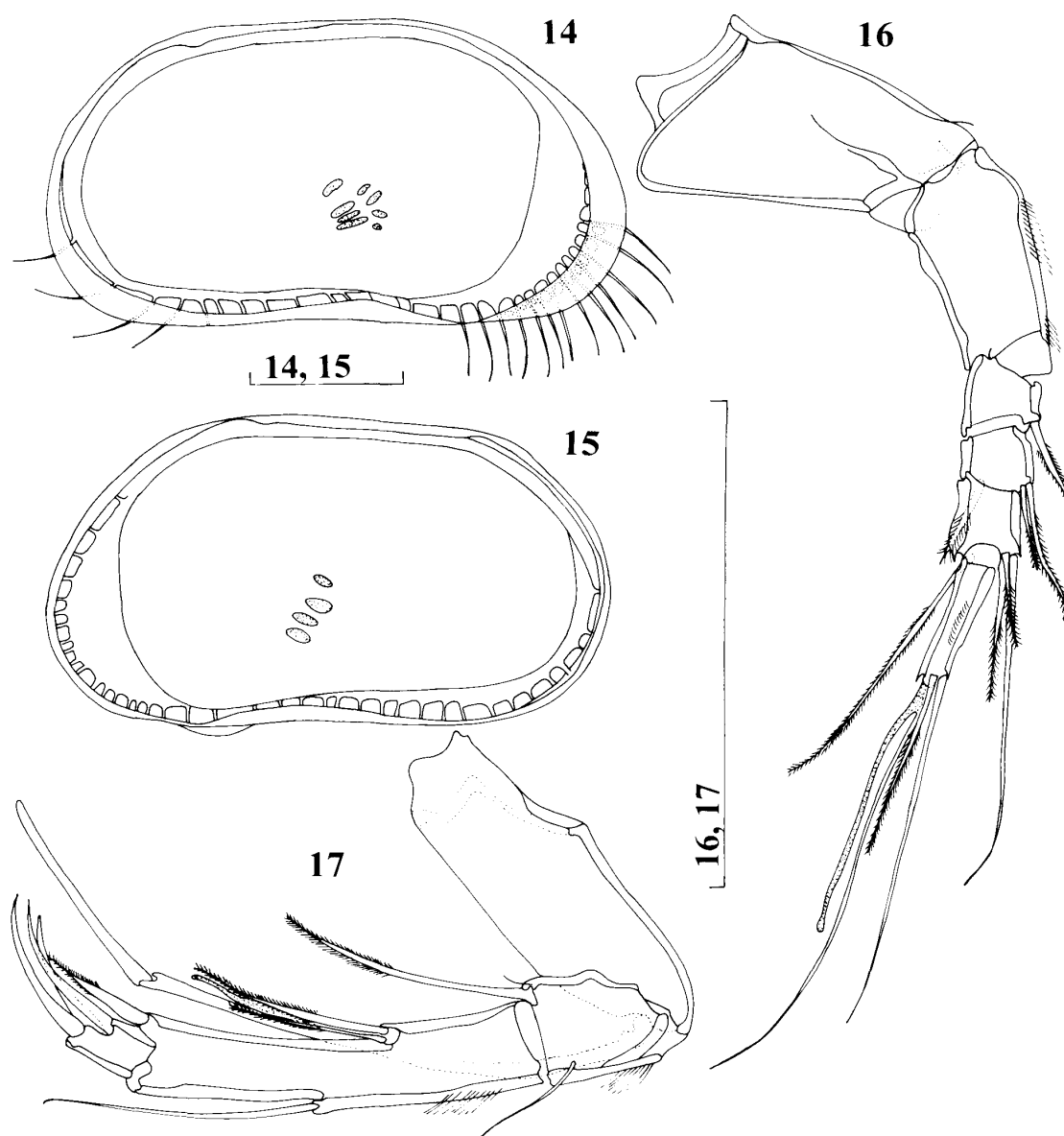
Figs 11–13. *Gomphodella maia* De Deckker, 1981, female (0.428 mm, WAM C28408). 11, Antenna; 12, antenna; 13, mandibula. Scale=0.1 mm.

ing distal end of second segment). Terminal claw curved, as long as terminal segment. Length ratio of three endopodal segments 1.88 : 1.00 : 1.20.

Third walking leg with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and posteroproximally with one pappose seta. First endopodal segment with one pappose seta anterodistally. Terminal claw long and thin, 1.81 times as long as terminal segment. Length ratio of three endopodal segments 3.09 : 1.00 : 1.24.

Posterior part of body (Fig. 10) with one strong seta proximally and several bunches of hairs and spinules both proximally and distally. Both furcae developed and consisting of three hirsute furcal lobes and two furcal setae. Genital operculae simple.

Male. Length of carapace 0.414 mm. In dorsal and ventral views (Figs 3, 4),



Figs 14–17. *Gomphodella maia* De Deckker, 1981, male (0.414 mm, WAM C28410). 14, Left valve, internal view; 15, right valve, internal view; 16, antennula; 17, antenna. Scales=0.1 mm.

males differing from females in lemon-shaped carapace with both ends pointed. Greatest width situated around middle, equalling 56.6% of length. In lateral view (Figs 14, 15), generally similar to female; greatest height about 50% of length.

Antennula (Fig. 16) with all setae being slightly longer than in females. Length ratio of endopodal segments 3.50:1.16:1.00:1.16:2.08.

Antenna (Fig. 17) with exopodite relatively longer than in female. Length/width ratio of penultimate segment 4.80:1.00.

Body of hemipenis (Fig. 18) muscular, but distal lobe prominent and articulated. Distal lobe triangular with blunt tip, its base consisting of two semi-lobes, one bearing long distal protuberance. Copulatory process well sclerotized, long



Figs 18–21. *Gomphodella maia* De Deckker, 1981, male (0.414 mm, WAM C28410). 18, Hemipenis; 19, first walking leg; 20, second walking leg; 21, third walking leg. Scale=0.1 mm.

and curved.

Walking legs as illustrated (Figs 19–21).

Distribution. Live specimens were collected in Fresh Dip Lake (South Australia), the type locality, and Turners Spring in Margaret River (Western Australia). According to De Deckker (1981a), empty valves were found in Blue Lake (Mount Gambier, South Australia) and in two unknown sites in north-western Tasmania.

Remarks. When compared with De Deckker's (1981a) description the following differences between the type material and the specimens from the population

of Margaret River can be noticed: (1) on the fourth antennular segment, the paratype female carries just one seta anteriorly, while in the Margaret River population there are two setae; (2) the fifth segment of the same appendage carries only two setae anteriorly in the paratype, whereas in the population there are clearly three setae; (3) the holotype male has two setae posteriorly on the antenna, while all our specimens have three setae; (4) the antenna is three-segmented in the holotype (the penultimate and terminal segments are fused), whereas it is four-segmented in my specimens; (5) the mandibular palp is three-segmented in the paratype, but four-segmented in our populations; (6) the protopodite of the first walking leg in the holotype has only one seta antero-distally, but two setae in the Margaret River population; and (7) in the holotype all walking appendages lack an articulation between the protopodite and endopodite. The appearance of the hemipenis is also somewhat different. In the studied male the distal lobe has a base consisting of two semi-lobes, one of which bears distally a long protuberance. De Deckker (1981a) did not mention any long protuberance or semi-lobes; however, the general outline of the hemipenis of the holotype is very similar to that of the male from Margaret River. All mentioned differences are probably due to an incorrect examination of the soft parts by De Deckker (1981a), because no other member of the Limnocytheridae has fused protopodites and endopodites of the walking legs, or fused penultimate and terminal segments of the antenna.

The very similar valve shape and the similar sort of sexual dimorphism of the carapace were the reasons to identify the examined specimens as *Gomphodella maia*.

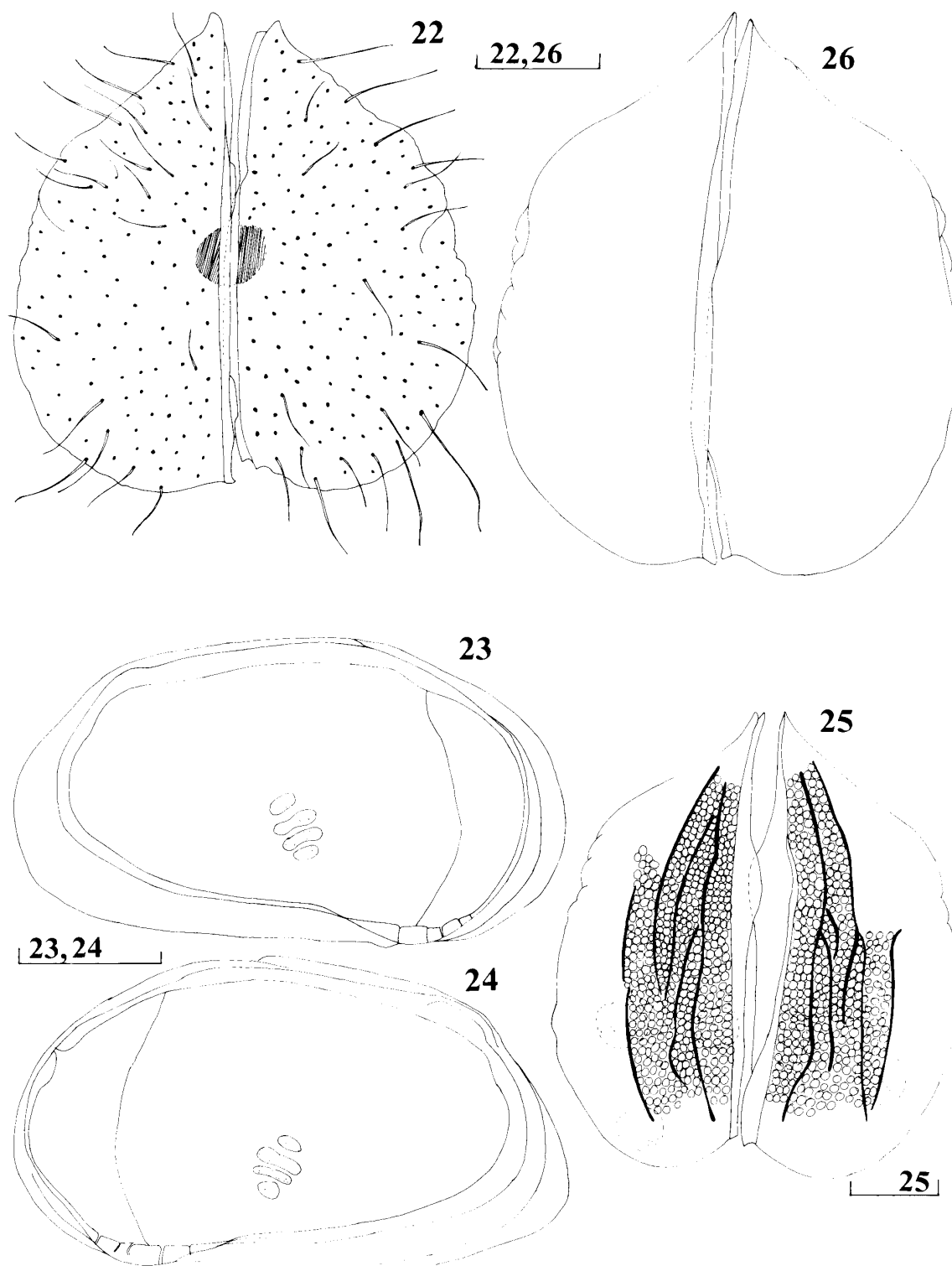
***Gomphodella hirsuta* sp. nov.**

(Figs 22–45, 93C, D, 94A)

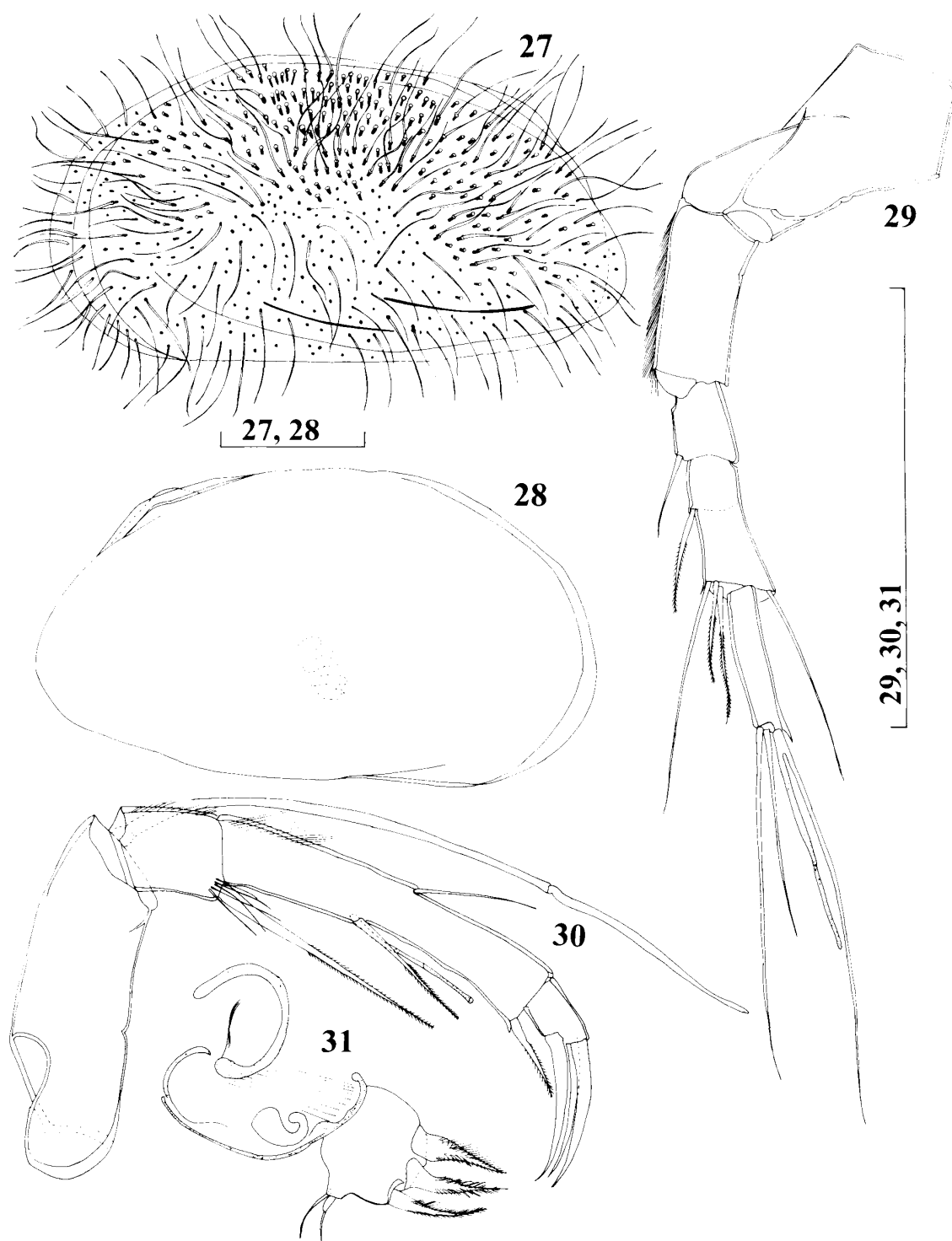
Material examined. Holotype: female, WAM C28386 (on slide), Newman Bore near W126, Newman Borefield, Pilbara, Western Australia, Australia, 23°15'S 119°53'E, 12 November 1998, coll. S. M. Eberhard (BES 3577). Allotype: male, WAM C28387 (on slide), same data as holotype. Paratypes: 9 specimens, including 1 female, 3 males, and 5 juveniles, WAM C 28388 (1 male on slide), WAM C 28389 (the rest in alcohol), same data as holotype.

Non-types: 1 female, WAM C28390 (on slide), Newman Bore, Newman Borefield, Pilbara, Western Australia, 23°13'S 119°53'E, 11 November 1999, WP 120, coll. S. M. Eberhard (BES 3529); 1 female, WAM C28391 (in alcohol), similar locality, 23°15'07"S 119°53'37"E, February 2001, sample number 45.1, bore WP126NR, observation bore 23, coll. G. Humphreys, J. Bradbury, and K. Armstrong (BES 5586); 1 male, WAM C28392 (in alcohol), similar locality, 23°50'S 119°53'E, February 2001, sample number 44.1, Bore T399, observation bore 23, coll. G. Humphreys, J. Bradbury, and K. Armstrong (BES 5585); 4 females, 2 males, WAM C28393 (in alcohol) (RBINS), similar locality, February 2001, sample number 46.1, Bore T401, observation bore 23, coll. G. Humphreys, J. Bradbury, and K. Armstrong (BES 5590); 11 females, 7 males, and 3 juveniles, WAM C28394 (2 females and one male on SEM stub, others in alcohol), similar locality, 23°15'07"S 119°53'37"E, February 2001, sample number 45.1, Bore WP126NR, observation bore 23, coll. G. Humphreys, J. Bradbury, and K. Armstrong (BES 5587).

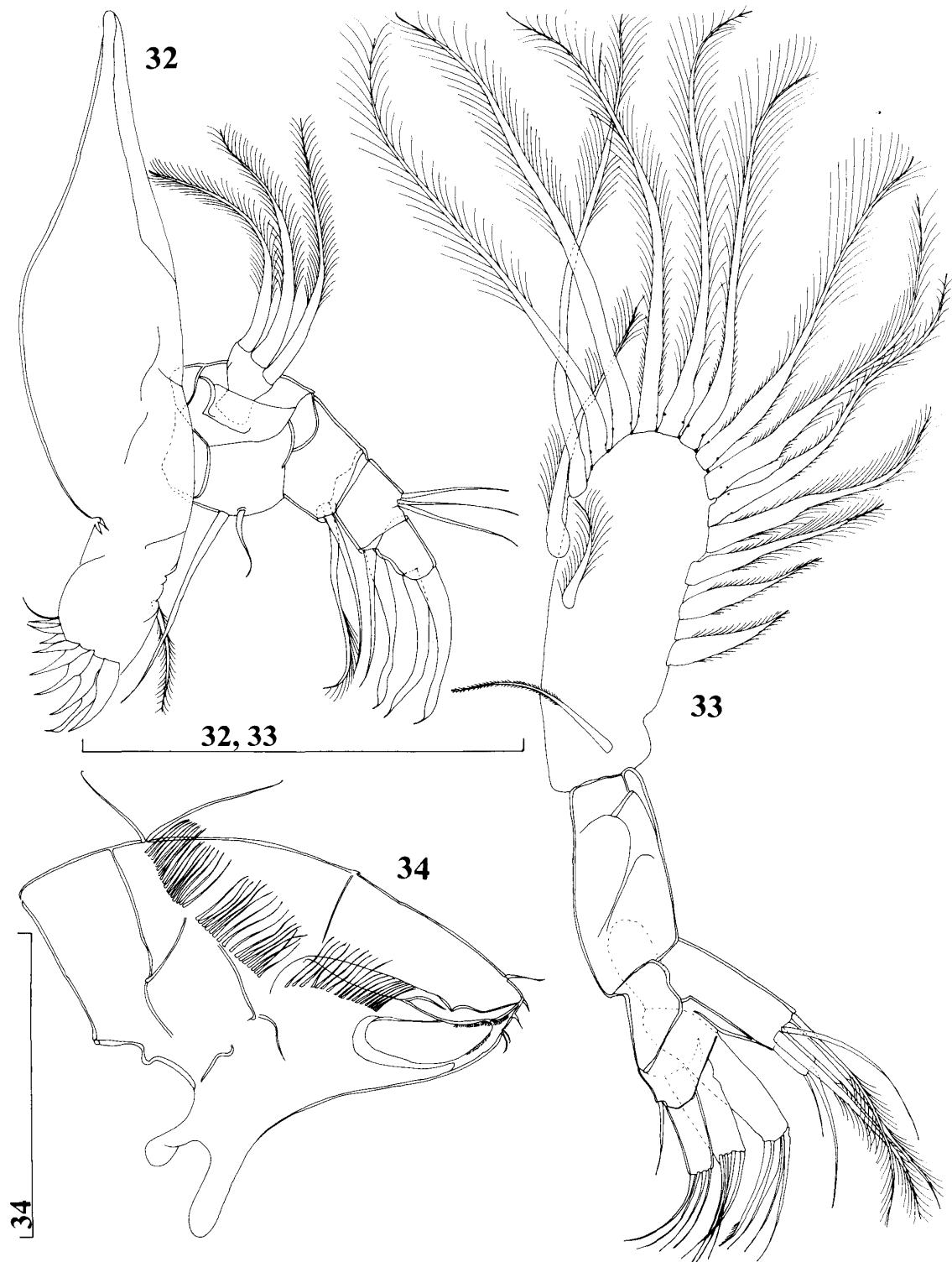
Description. *Female* (holotype). Length of carapace 0.383 mm. In dorsal view



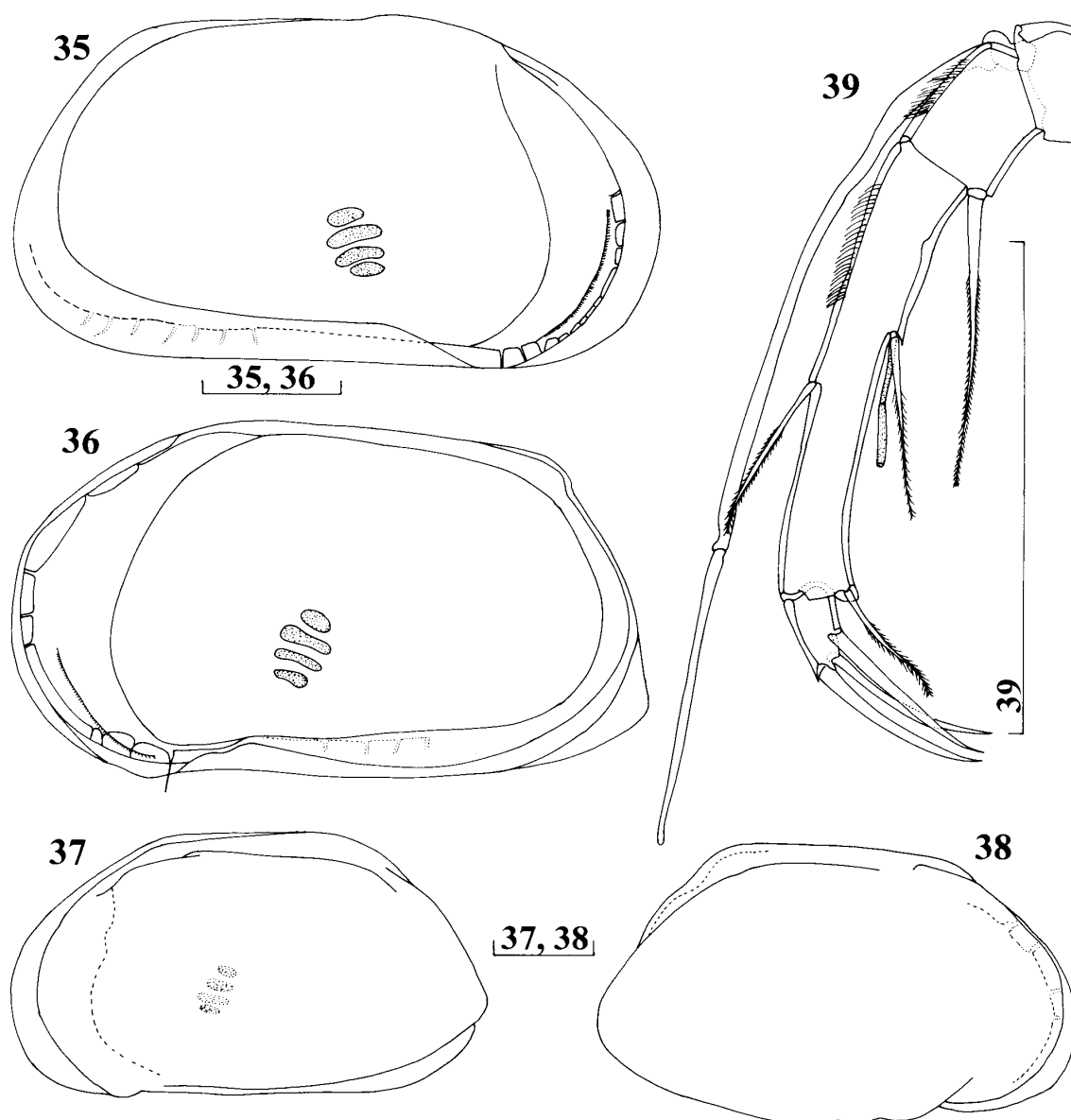
Figs 22–26. *Gomphodella hirsuta* sp. nov. 22, 23, 25, Holotype female (0.383 mm, WAM C28386); 24, non-type female (0.385 mm, WAM C28390); 26, paratype male (0.469 mm, WAM C28388). 22, Carapace, dorsal view; 23, left valve, internal view; 24, right valve, internal view; 25, carapace, ventral view; 26, carapace, dorsal view. Scales=0.1 mm.



Figs 27–31. *Gomphodella hirsuta* sp. nov. 27, 29–31, Holotype female (0.383 mm, WAM C28386); 28, non-type female (0.385 mm, WAM C28390). 27, Left valve, external view; 28, right valve, external view; 29, antennula; 30, antenna; 31, furca and genital field. Scales=0.1 mm.

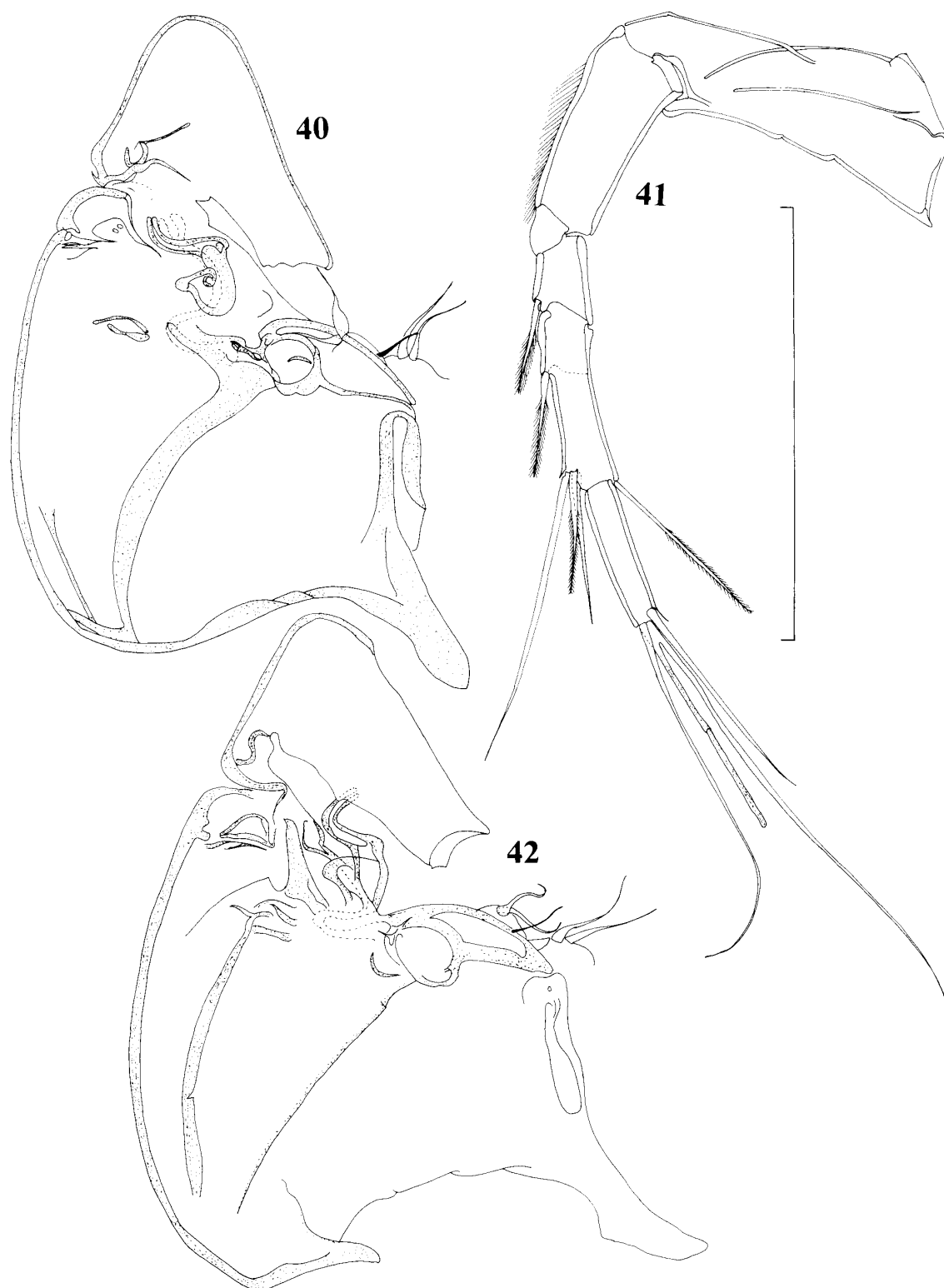


Figs 32-34. *Gomphodella hirsuta* sp. nov., holotype female (0.383 mm, WAM C28386). 32, Mandibula; 33, maxillula; 34, upper lip. Scales=0.1 mm.

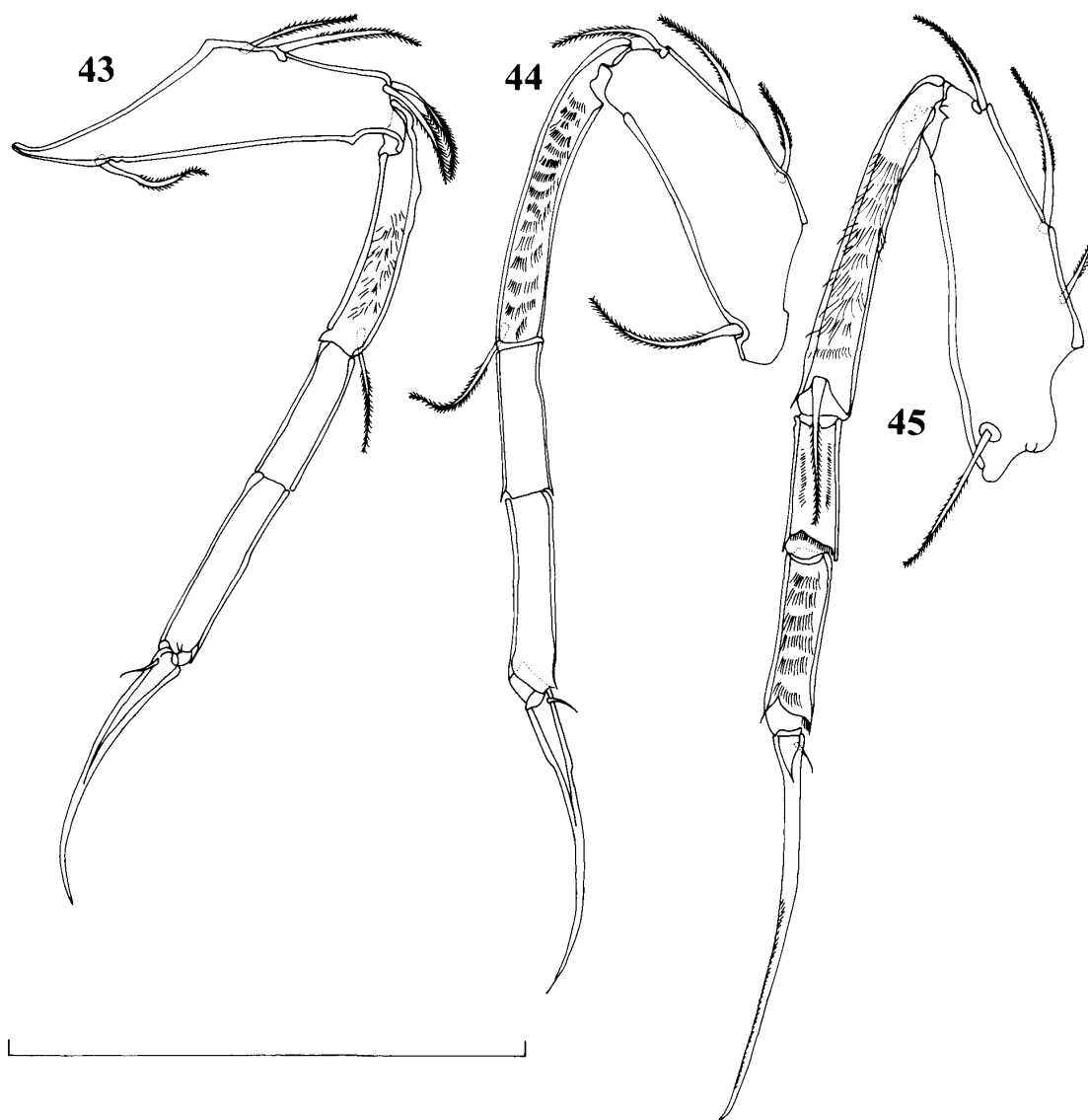


Figs 35–39. *Gomphodella hirsuta* sp. nov. 35, 36, 39, Allotype male (0.456 mm, WAM C28387); 37, 38, paratype male (0.469 mm, WAM C28388). 35, Right valve, internal view; 36, left valve, internal view; 37, right valve, external view; 38, left valve, external view; 39, antenna. Scales=0.1 mm.

(Fig. 22), carapace more squarish than oviform. Greatest width slightly behind middle, equalling 80% of length. Anterior end cuneiform, posterior end rounded. Eyes clearly visible. Hinge lophodont with left valve overlapping right valve dorsally and posteriorly. In ventral view (Fig. 25), right valve overlapping left, with several ridges visible centrally (Fig. 93C). In lateral view (Figs 23, 24), dorsal margin almost straight and slightly inclined towards posterior end. Greatest height situated at first third of length, equalling about 56% of length. Frontal margin clearly wider than caudal one. Ventral margin slightly convex around mouth region. Selva developed on left and right valves, inwardly displaced at both ends. Flange de-



Figs 40–42. *Gomphodella hirsuta* sp. nov. 40, 41, Allotype male (0.456 mm, WAM C28387); 42, paratype male (0.469 mm, WAM C28388). 40, Hemipenis; 41, antennula; 42, hemipenis. Scale=0.1 mm.



Figs 43–45. *Gomphodella hirsuta* sp. nov., allotype male (0.456 mm, WAM C28387). 43, First walking leg; 44, second walking leg; 45, third walking leg. Scale=0.1 mm.

veloped on both valves. Calcified inner lamella narrow. Fused zone unrecognizable posteriorly, but well developed anteriorly with several irregular and unequally long pore canals. Four adductor muscle scars present. Valves well calcified, ventrally ornamented with dense pits. Carapace also covered with relatively long, stiff, and very dense setae originating from large, cylindrical, distally dilated warts (Figs 93D, 94A).

Antennula (Fig. 29) five-segmented. First segment with no seta. Second segment with fringe of fine setae along anterior edge. Third segment with one apical seta anteriorly, this not reaching distal end of penultimate segment. Fourth and fifth segments partially fused and bearing one pappose seta medially, this slightly exceeding distal end of fifth segment; also bearing three setae anterodistally, two of them pappose and subequally long, not reaching distal end of terminal segment,

third one smooth and longer, exceeding distal end of terminal segment; and with one fine seta posterodistally, exceeding tip of terminal segment. Terminal segment with three setae and one aesthetasc, latter proximally fused with longest seta. Length/width ratio of fused part 2.40:1. Longest seta 0.75 times as long as four distal segments combined; one of other two setae slightly shorter than previous seta, shortest seta as long as aesthetasc, about 1.6 times longer than terminal segment. Length ratio of four distal segments 2.25:1.00:1.90:1.90.

Antenna (Fig. 30) four-segmented. Exopodite not reaching distal end of terminal claws. First segment without any seta; second segment with one seta being posterodistally pappose and exceeding middle of penultimate segment; same segment with few long, individual hairs posteromedially, and bunch of hairs anteriorly. Third segment with two setae posteriorly (subequally long, not reaching distal end of their segment), one of these being an aesthetasc. Same segment with one swollen, pappose seta posterodistally and one thin seta anteriorly, latter almost reaching distal end of penultimate segment. Penultimate segment with bunch of hairs anteroproximally. Terminal segment with three equally long claws. Length/width ratio of penultimate segment 5.60:1.00.

Mandibula (Fig. 32) with nine teeth on coxa. Exopodite with three long, pappose rays. Palp four-segmented; first segment with two setae on inner edge (one long, other considerably shorter), no seta on outer edge; second segment with two setae on inner edge, these subequally long and exceeding distal end of penultimate segment, and no seta on outer edge; third segment with three setae on outer edge, these subequally long and reaching middle of terminal claws, also with one thin seta on outer edge, and another transformed into claw; fourth segment with two claws. All mandibular claws (on penultimate and terminal segments) curved, swollen distally, and with spine-like tips.

Upper lip (Fig. 34) covered frontally with very long setae, attachment short and stout.

Maxillula (Fig. 33) with three endites elongated and each with approximately four claw-like setae. Palp weakly sclerotized and incompletely segmented; "first" segment with four setae (three of them pappose); "second" segment with one apical seta and one small seta inserted on lateral apical corner.

First walking leg with protopodite armed anteriorly with one proximal seta, one medial seta, and two distal setae, all pappose, also with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally (reaching middle of following segment). Terminal claw with one small seta posteroproximally. Claw smooth and 1.4 times as long as terminal segment. Length ratio of three endopodal segments 1.60:1.00:1.30.

Second walking leg with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, also with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally (almost reaching distal end of following segment). Terminal claw curved and 1.5 times as long as terminal segment. Length ratio of three endopodal segments 2.1:1:1.3.

Third walking leg with protopodite armed anteriorly with one proximally situated seta, one medial seta, and one distal seta, all pappose, also with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally. Terminal claw long and thin, 2.1 times as long as terminal segment. Claw

with small seta posterodistally. Length ratio of three endopodal segments 2.40:1.00:1.30.

Posterior part of body with both furcae developed and consisting of three hirsute furcal lobes and two thin furcal setae. Genital operculae simple (Fig. 31).

Male (allotype). Length of carapace 0.456 mm. In dorsal view, male not differing from female, greatest width equal to about 80% of length. In lateral view (Figs 35, 36), also without much difference compared with female. Greatest height equalling about 53% of length.

Length ratio of four distal segments of antennula (Fig. 41) 2.60:1.00:2.50:2.00. Other appendages (Figs 39, 43–45) generally similar to those of female holotype.

Body of hemipenis (Figs 40, 42) not very muscular, but distal lobe prominent and articulated. Distal lobe triangular with squarish base and blunt tip, its dorsal margin almost straight but ventral one shaped as small elephant trunk. On main body, upper ramus relatively long and slightly sinusoid, well sclerotized, distally biramous. Copulatory process well sclerotized, long, and distally curved. In addition to two normal furcal setae, another very thin seta present on main body of hemipenis.

Variability. Hemipenis of the paratype male (Fig. 42) is less chitinous on the distal lobe. No other form of variability was observed.

Etymology. The specific name, *hirsutus*, is a Latin adjective meaning hairy.

Distribution. Known from several bores in the calcrete systems of the Pilbara Region of Western Australia.

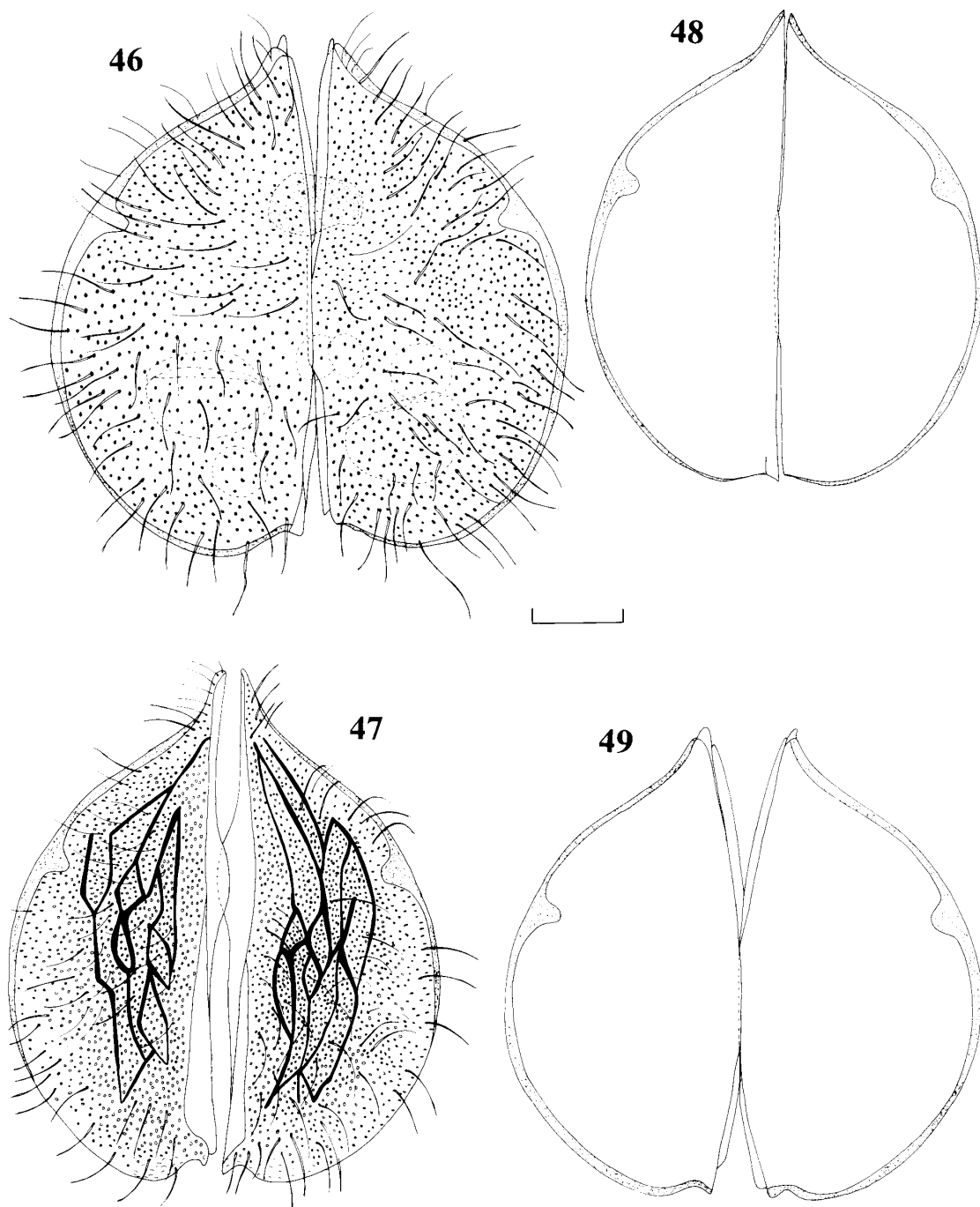
***Gomphodella glomerosa* sp. nov.**

(Figs 46–71, 92C, D, 93A)

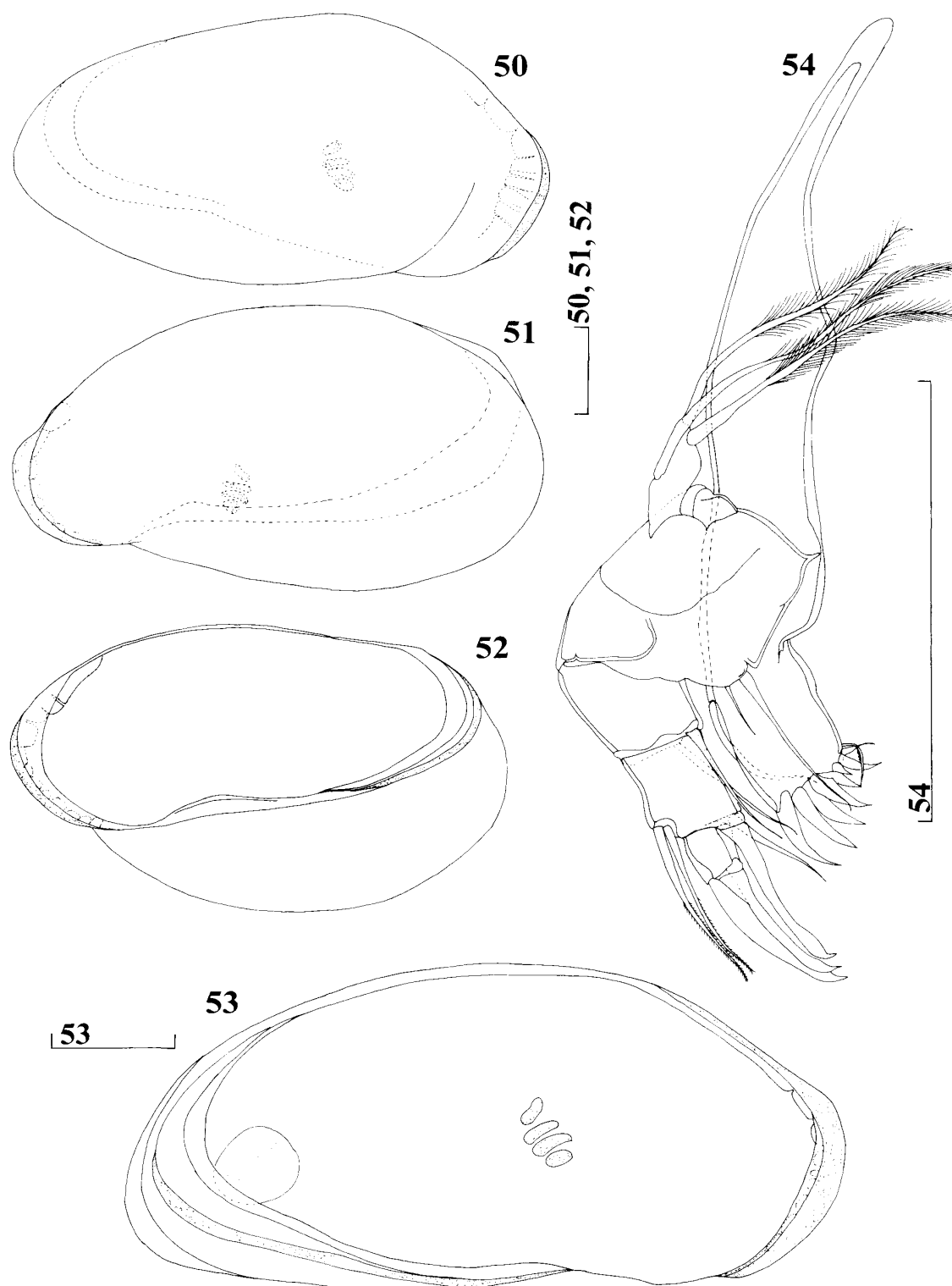
Material examined. Holotype: female (WAM C28377, on slide), observation bore next to Pump 1, Lake Violet Borefield, Wiluna, Murchison, Western Australia, 26°40'S 120°14'E, 18 May 1999, coll. W. F. Humphreys and H. J. Hahn (BES 7243). Allotype: male (WAM C28378, on slide), same data as holotype. Paratypes: 14 specimens, including 7 females, 5 males, and 2 juveniles (1 male on slide, WAM C28379; 1 female on slide, WAM C28380; 1 male and 1 female on the SEM stub, WAM C28382; the rest in alcohol, WAM C28381), same data as holotype.

Non-types: 1 female (WAM C28383, in alcohol), observation bore next to Pump 4, Lake Violet Borefield, Wiluna, Murchison, Western Australia, 26°41'S 120°13'E, 18 May 1999, coll. W. F. Humphreys and H. J. Hahn (BES 7152); 1 female (WAM C28384, in alcohol), sample 4 (mineral exploration bore), Lake Way, Uranium Exploration Area, Murchison, Western Australia, 26°41'S 120°20'E, 19 May 1999, coll. W. F. Humphreys and H. J. Hahn (BES 7178); 3 females (WAM C28385, in alcohol) and 2 males (RBINS), sample 7c, site 261, Murchison, Western Australia, 26°39'S, 120°19'E, coll. W. F. Humphreys and H. J. Hahn (BES 7213).

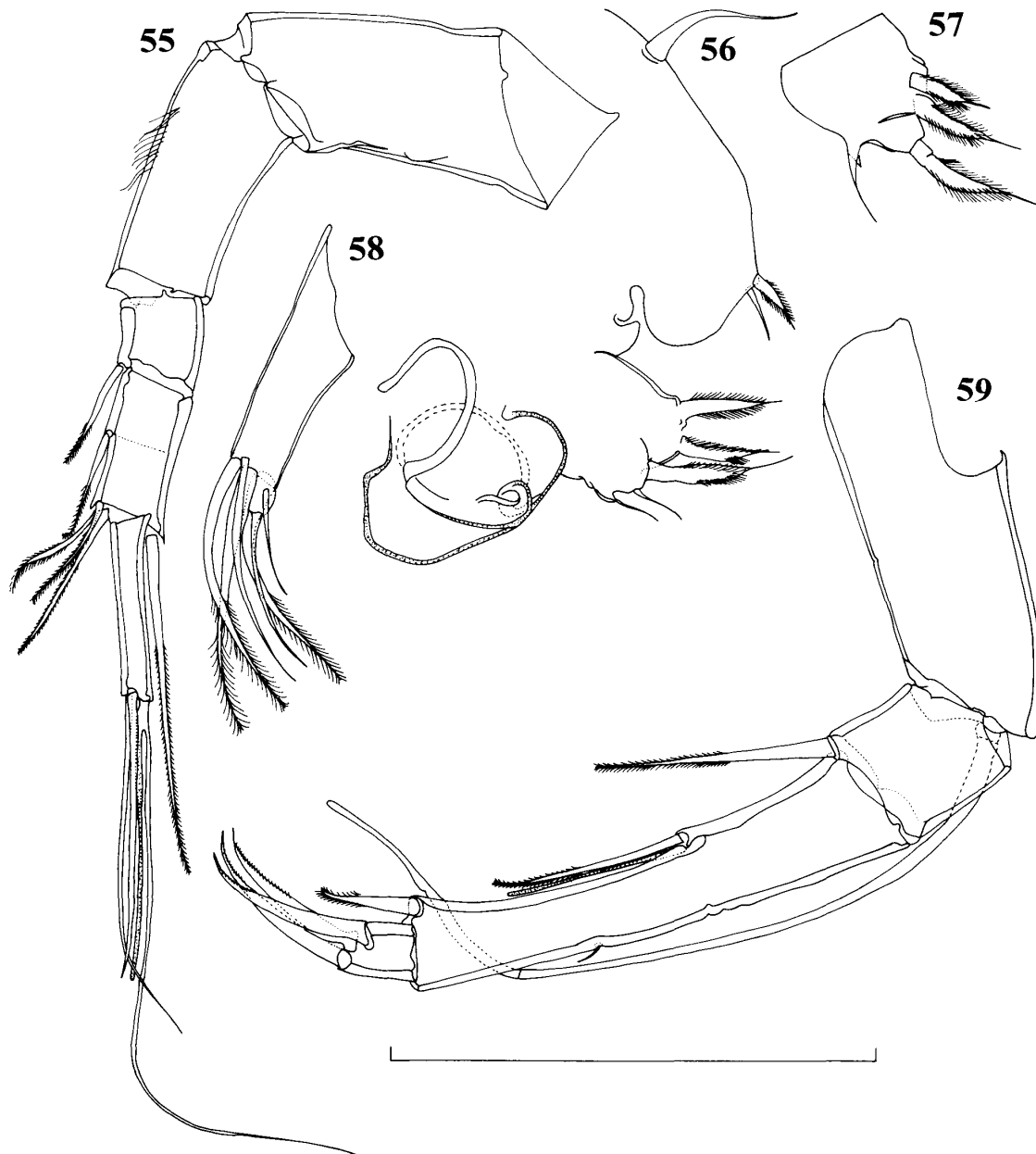
Description. *Female* (holotype). Length of carapace 0.563 mm. In dorsal view (Fig. 46), carapace strongly oviform with greatest width around middle, width equalling 84% of length. Anterior end cuneiform, posterior end widely rounded. Eyes clearly visible, but pale. Hinge lophodont with left valve overlapping right valve dorsally and posteriorly. In ventral view (Fig. 47), right valve overlapping left with several ridges visible centrally. In lateral view (Figs 52, 53, 92C), valves irregularly elliptical; dorsal margin arched, with greatest height situated at first



Figs 46–49. *Gomphodella glomerosa* sp. nov. 46, 47, Holotype female (0.563 mm, WAM C28377); 48, paratype male (0.431 mm, WAM C28382); 49, allotype male (0.544 mm, WAM C28378). 46, 48, 49, Carapace, dorsal view; 47, same, ventral view. Scale=0.1 mm.

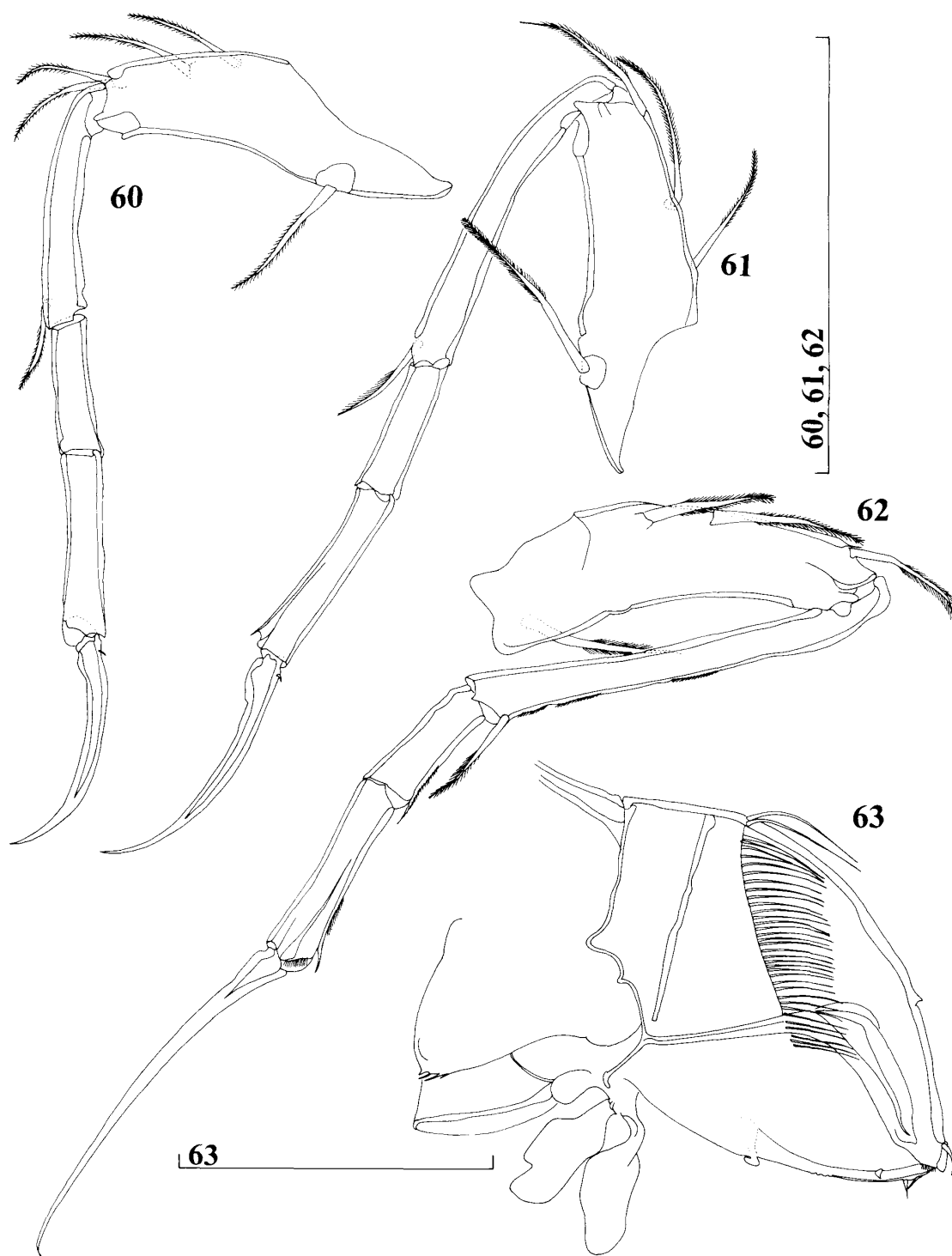


Figs 50–54. *Gomphodella glomerosa* sp. nov. 50, 51, Paratype female (0.597 mm, WAM C28380); 52–54, holotype female (0.563 mm, WAM C28377). 50, Right valve, external view; 51, left valve, external view; 52, right valve, oblique view; 53, left valve, internal view; 54, mandibula. Scales=0.1 mm.

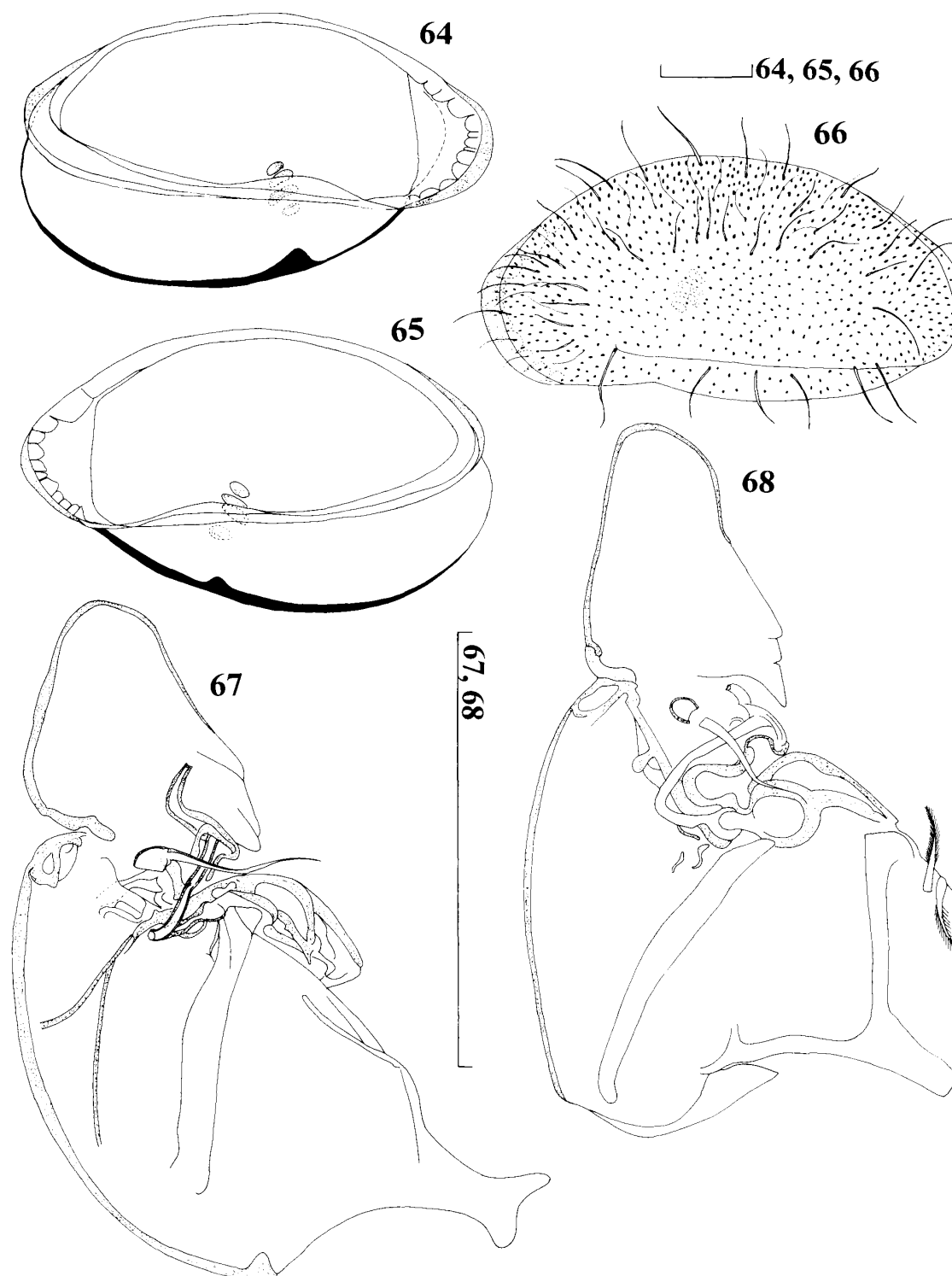


Figs 55–59. *Gomphodella glomerosa* sp. nov., holotype female (0.563 mm, WAM C28377). 55, Antennula; 56, end of body with furca and genital field; 57, furca; 58, maxillular palp; 59, antenna. Scale=0.1 mm.

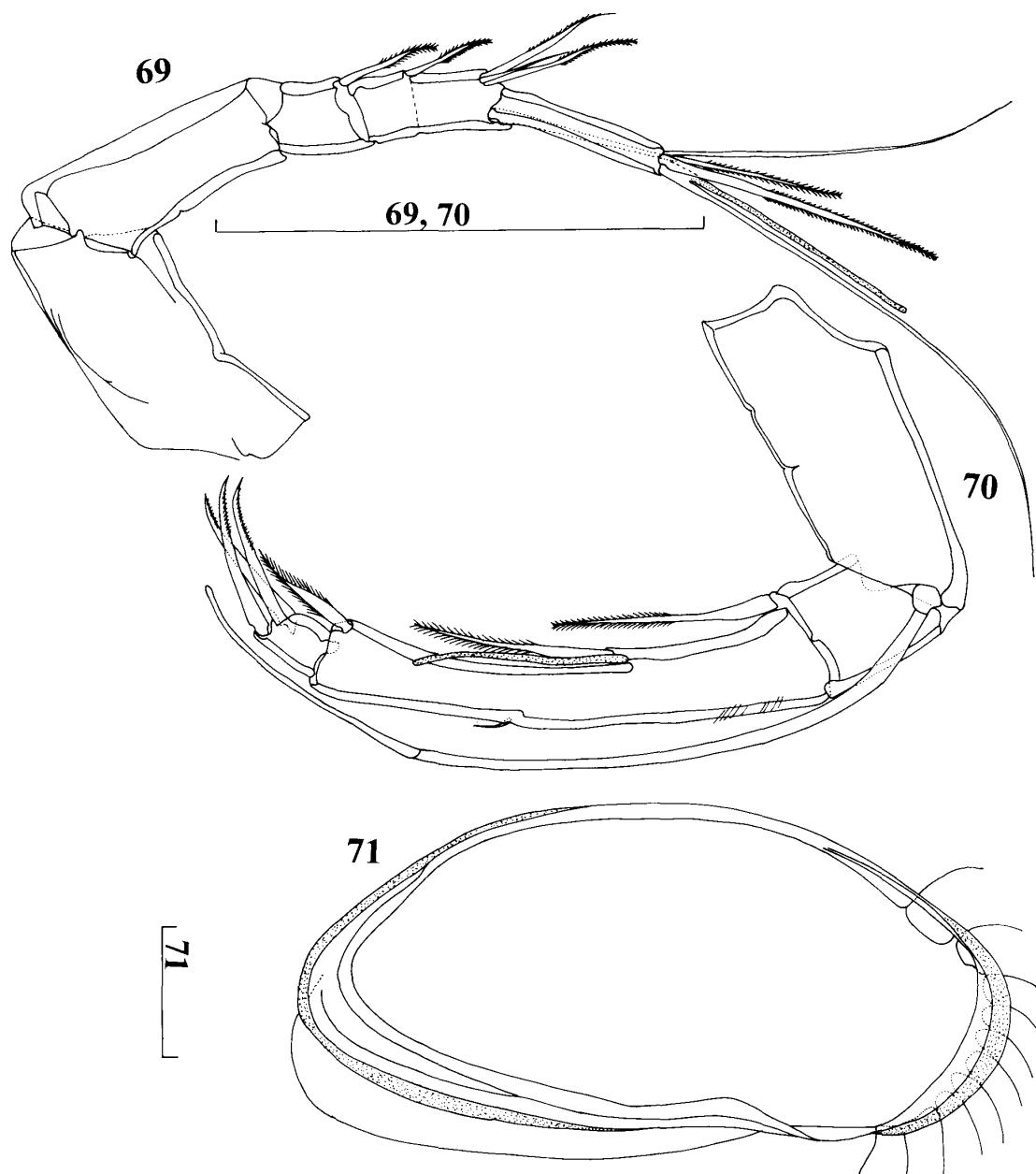
third of length, equalling about 50% of length. Frontal margin clearly wider than caudal one, latter slightly pointed. Ventral margin concave around mouth region, but difficult to observe when viewed externally, because of belly-like extension of carapace covering ventral margin. Selvage developed on left and right valves, peripheral anteriorly and inwardly displaced posteriorly. Caudal flange developed on both valves. Calcified inner lamella narrow. Fused zone unrecognizable posteriorly, but well developed frontally with several irregular and unequally long pore canals (Fig. 92D). Four adductor muscle scars present. Valves well calcified, orna-



Figs 60–63. *Gomphodella glomerosa* sp. nov. 60–62, Holotype female (0.563 mm, WAM C28377); 63, allotype, male (0.544 mm, WAM C28378). 60, First walking leg; 61, second walking leg; 62, third walking leg; 63, upper lip. Scales=0.1 mm.



Figs 64–68. *Gomphodella glomerosa* sp. nov. 64–67, Allotype male (0.544 mm, WAM C28378); 68, paratype male (0.526 mm, WAM C28379). 64, Left valve, oblique view; 65, right valve, oblique view; 66, left valve, external view; 67, 68, hemipenis. Scales=0.1 mm.



Figs 69–71. *Gomphodella glomerosa* sp. nov. 69, 70, Allotype male (0.544 mm, WAM C28378); 71, paratype male (0.526 mm, WAM C28379). 69, Antennula; 70, antenna; 71, left valve, internal view. Scales=0.1 mm.

mented with small, dense pits (Fig. 93A). Carapace covered with relatively long, almost stiff setae originating from small, cylindrical, and very dense warts.

Antennula (Fig. 55) five-segmented. First segment with no seta. Second segment with fine hairs on anterior edge, no seta on posterior edge. Third segment with one apical seta anteriorly, this distally pappose and not reaching distal end of penultimate segment. Fourth and fifth segments partially fused, with one pappose seta medially, this seta slightly exceeding distal end of fifth segment; three pappose setae anterodistally, of almost subequal length, and not reaching distal end of ter-

terminal segment; and one strong pappose seta posterodistally, twice as long as terminal segment. Fifth segment with three setae, and one aesthetasc proximally fused with longest seta, length/width ratio of fused part of seta and aesthetasc 3.50:1.00, and longest seta 0.9 times as long as all endopodal segments combined. Other two terminal setae and aesthetasc much shorter than this, about twice as long as terminal segment. Length ratio of four distal segments 2.80:1.00:1.70:1.90.

Antenna (Fig. 59) four-segmented. Exopodite reaching distal end of terminal claws. First segment without any setae, second with one seta posterodistally, this pappose and slightly exceeding middle of penultimate segment. Third segment with one seta and one aesthetasc posteromedially, and two setae anteriorly (subequally long, and not reaching distal end of same segment); same segment with one swollen, pappose seta posterodistally, one very thin and short seta anteromedially. Fourth segment with three finely serrated claws, all equally long and slightly curved. Length/width ratio of penultimate segment 5:1.

Mandibula (Fig. 54) with three long, pappose rays on protopodite. Palp four-segmented; first segment with two setae on inner edge (one long, other considerably shorter); second segment with two setae on inner edge, these subequally long and exceeding distal end of penultimate segment; third segment with two subequally long pappose setae on outer edge, these not reaching distal end of terminal claws, and one thin and one claw-like seta on inner edge; fourth segment with two claws. All mandibular claws (on penultimate and terminal segments) curved, distally swollen, and with spine-like tips.

Upper lip (Fig. 63) covered frontally, with very long setae, attachment short and stout.

Maxillula with three endites elongated and armed with approximately four claw-like setae each. Palp (Fig. 58) weakly sclerotized and incompletely segmented; first segment with four well developed setae (three of them pappose); "second" segment with one apical seta and one small seta inserted laterally.

First walking leg (Fig. 60) with protopodite armed anteriorly with one proximal seta, one medial seta, and two distal setae, all pappose, and with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally (reaching middle of following segment). Terminal claw with one small seta posteroproximally. Claw smooth, 1.23 times as long as terminal segment. Length ratio of three endopodal segments 1.80:1.00:1.40.

Second walking leg (Fig. 61) with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally (reaching middle of following segment). Terminal claw curved, 1.3 times as long as terminal segment. Length ratio of three endopodal segments 2.40:1.00:1.40.

Third walking leg (Fig. 62) with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally. Terminal claw long and thin, 1.9 times as long as terminal segment. No small seta observed posterodistally on claw. Length ratio of three endopodal segments 3.50:1.00:1.70.

Posterior part of body (Fig. 56) with one long, strong dorsal seta, and two much shorter ventral setae. Both furcae developed (Fig. 57) and consisting of three hirsute furcal lobes and two thin furcal setae. Genital operculae simple.

Male (allotype). Length of carapace 0.544 mm. In dorsal view (Fig. 49), male not much different from female, just slightly thinner, greatest width 80% of length. In lateral view, also without much difference compared with female (Figs 64–66). Greatest height about 60% of length.

Antennula (Fig. 69) with length ratio of four distal segments 2.90:1.00:1.73:2.30. Other appendages generally similar to those of female holotype.

Body of hemipenis (Fig. 67) not very muscular, but distal lobe prominent and articulated. Distal lobe triangular, with squarish base and blunt tip, dorsal margin almost straight, ventral margin without chitinous distal rim, but with flag-like end with few folds. On main body upper ramus relatively long and slightly sinusoid, not very well sclerotized. Copulatory process well sclerotized, long and distally curved.

Variability. In one paratype male distal lobe of hemipenis seems to be more elongated and with more pointed flag-like part (Fig. 68), but this may be due to the slide preparation. No other form of variability was observed.

Etymology. The specific name, *glomerosus*, is a Latin adjective meaning like a ball, or rounded.

Distribution. Known from several localities in the Murchison Region of Western Australia.

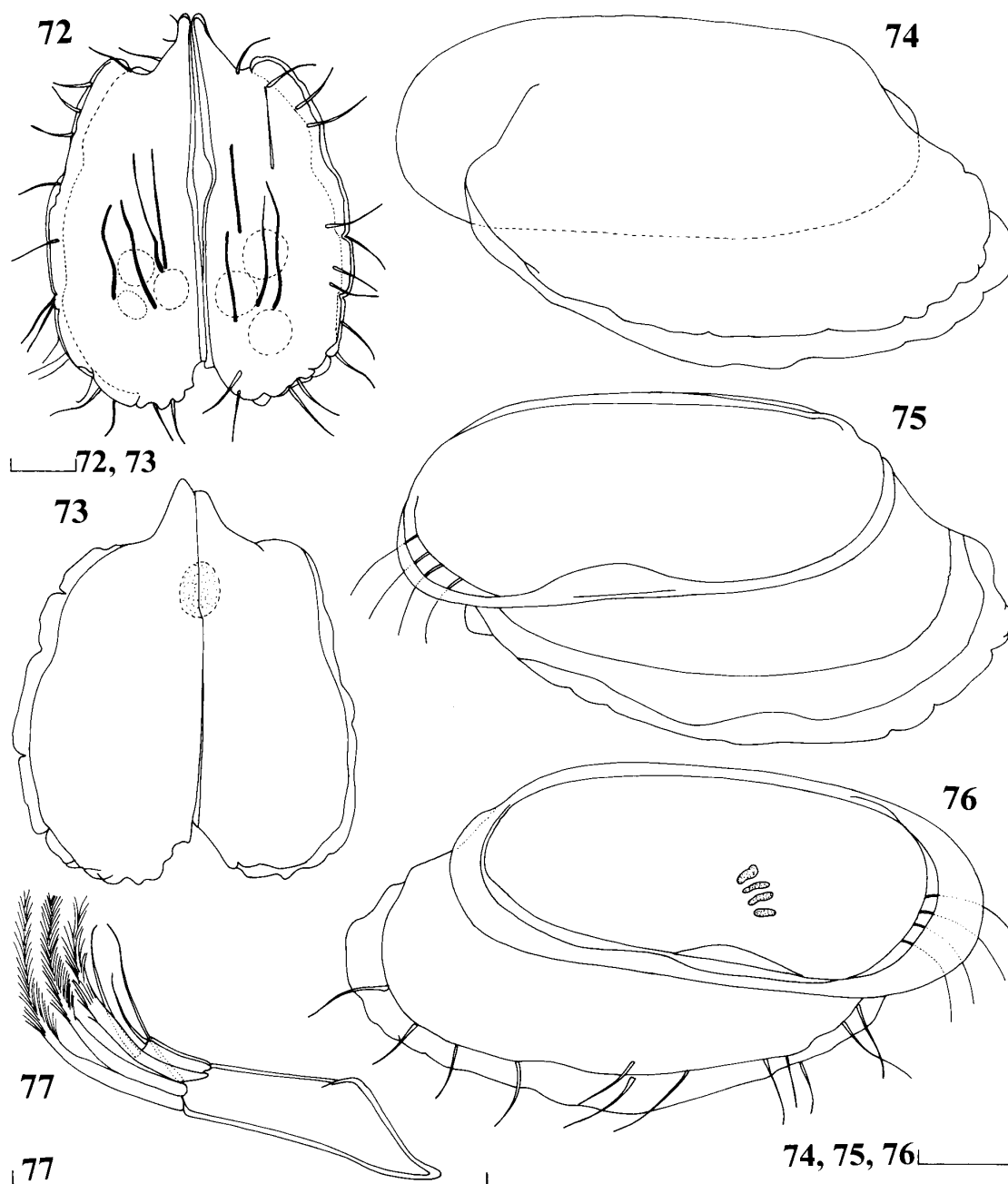
***Gomphodella yandii* sp. nov.**

(Figs 72–91, 94B–D)

Material examined. Holotype: female (WAM C33469, on slide), bore MS-10, Yandi, Murchison Region, Western Australia, Australia, 27°45'S 114°49'E, 23 November 1999, coll. G. Humphreys. Allotype: male (WAM C33469, on slide), same data as holotype. Paratypes: 9 specimens including 8 females and 1 male (1 female on slide, WAM C33470; 4 females on SEM stub and the rest in alcohol, WAM C33471), same data as holotype.

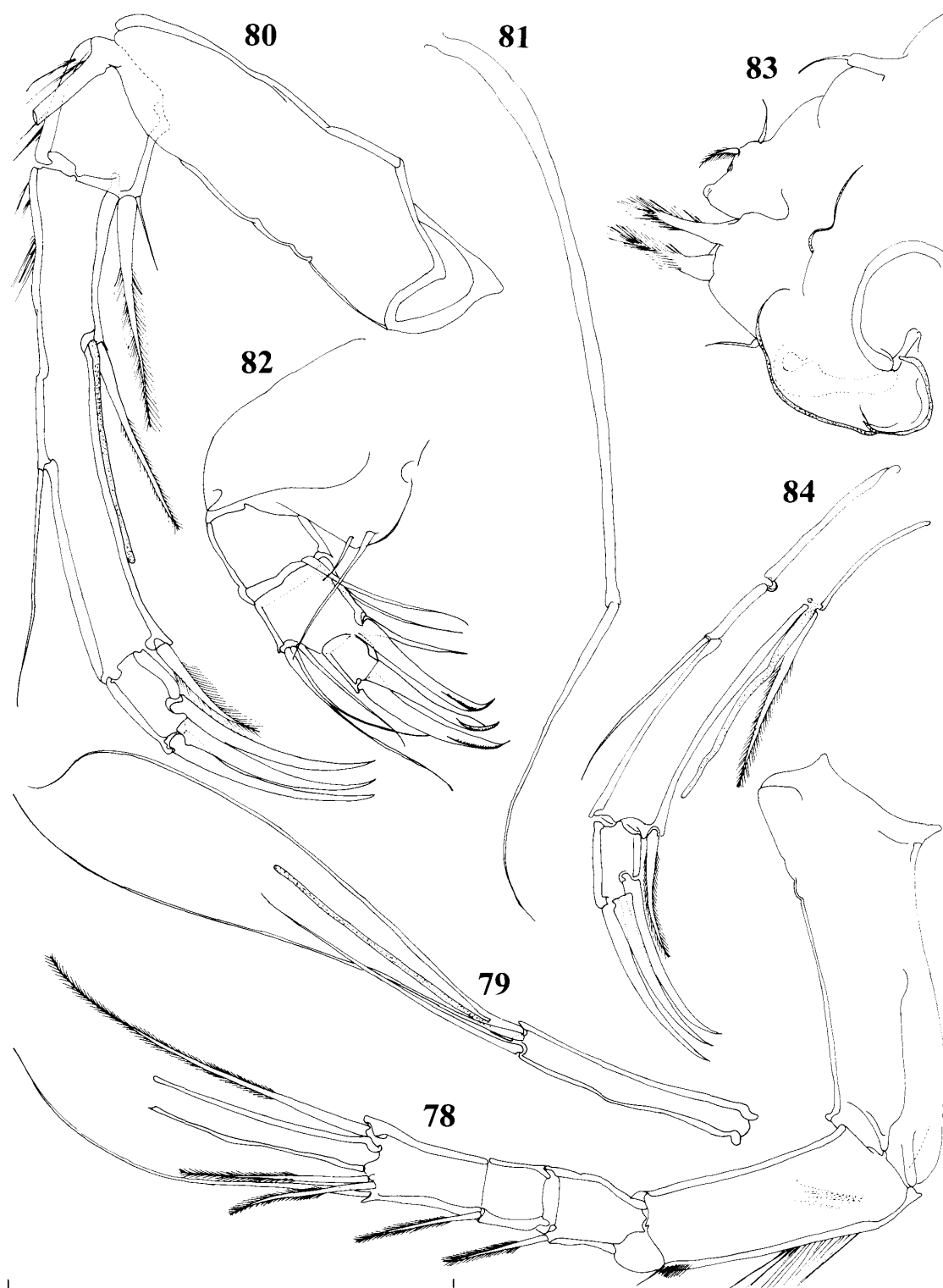
Description. *Female* (holotype). Length of carapace 0.567 mm. In dorsal view (Fig. 73) with greatest width at posterior end, width equalling 90% of length. Peripheral margins wavy. Anterior end cuneiform, posterior one widely rounded. Eyes lacking pigment. Hinge lophodont, with left valve clearly overlapping right valve dorsally, frontally, and caudally. Brood chamber well developed. In ventral view (Fig. 72), right valve overlapping left one, and several ridges visible centrally (Fig. 94B). In lateral view (Figs 74–76), valves irregularly elliptical. Each valve with wide, flat wing, with peripheral channel subdividing wing into two lists (Fig. 94C). Dorsal margin slightly curved, greatest height of carapace equalling about 41% of length. Anterior and posterior margins equally wide. Posterior and anterior flanges developed on both valves. Calcified inner lamella narrow. Posterior fused zone unrecognizable, but anterior one well developed and with several straight pore canals. Four adductor muscle scars present. Valves well calcified, densely ornamented with small pits (Fig. 94D). Carapace also covered, with relatively long, stiff setae originating from small warts. Sieve pores not visible due to very rough ornamentation.

Antennula (Figs 78, 79) six-segmented. First segment lacking setae. Second segment with fine hairs on anterior edge. Third segment with one apical seta anteriorly, this pappose and not reaching distal end of penultimate segment. Fourth seg-



Figs 72–77. *Gomphodella yandii* sp. nov., holotype female (0.567 mm, WAM C33469). 72, Carapace, ventral view; 73, carapace, dorsal view; 74, left valve, external view; 75, right valve, oblique view; 76, left valve, oblique view; 77, maxillular palp. Scales=0.1 mm.

ment with one apical pappose seta, this slightly exceeding distal end of penultimate segment. Fifth segment with three setae anterodistally (two subequally long and not reaching distal end of terminal segment, one 2.5 times longer) and one strong, pappose seta posterodistally (1.6 times longer than terminal segment). Sixth segment with three setae as well as one aesthetasc fused proximally with longest seta, length/width ratio of fused part 2.70:1.00. Two longest setae 0.7 times as long as five distalmost segments combined. Shortest seta 1.3 times longer than



Figs 78-84. *Gomphodella yandii* sp. nov. 78-83, Holotype female (0.567 mm, WAM C33469); 84, allotype male (0.500 mm, WAM C33469). 78, Antennula; 79, terminal segment of antennula; 80, antenna; 81, exopod of antenna; 82, mandibular palp; 83, posterior part of body; 84, antenna. Scale=0.1 mm.

terminal segment. Length ratio of four distal segments equalling 4.00:1.80:1.00:3.80.

Antenna (Figs 80, 81) four-segmented. Exopodite reaching distal end of terminal claws. First segment without any seta, second segment with one pappose seta posterodistally, this slightly exceeding middle of penultimate segment and accompanied by small setula. Third segment with two posteromedial setae (subequally long, not reaching distal end of the segment) and one aesthetasc, also with one swollen, pappose seta posterodistally and one long seta antero-medially. Fourth segment with three claws, all equally long and slightly curved. Length/width ratio of penultimate segment 8.30:1.00.

Mandibula (Fig. 82) with four-segmented palp. Exopodite with three long, pappose rays. First segment on palp with two setae on inner edge (one considerably shorter than others), without any seta on outer edge. Second segment with two setae on inner edge, these subequally long and exceeding distal end of terminal segment, and lacking any seta on outer edge. Third segment with three setae on outer edge, these subequally long and almost reaching distal end of terminal claws, and with one thin seta on outer edge and one claw. Fourth segment with two claws. All mandibular claws (on penultimate and terminal segments) curved, distally swollen, and with spine-like tips.

Maxillula with three endites elongated and armed with four claw-like setae each. Palp (Fig. 77) weakly sclerotized and incompletely segmented. First segment with four well developed setae (three of them pappose), second segment with one apical seta and one small seta inserted laterally.

First walking leg (Fig. 89) with protopodite armed anteriorly with one proximal seta, one medial seta, and two distal setae, all pappose, and with one pappose seta posteroproximally. First endopodal segment with one pappose seta anterodistally (reaching distal end of second segment). Terminal claw with one small seta posteroproximally. Claw smooth and 1.28 times as long as terminal segment. Length ratio of three endopodal segments 2.00:1.00:1.30.

Second walking leg (Fig. 90) with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and with one pappose seta posteroproximally. First endopodal segment without any seta. Terminal claw slightly curved and 1.25 times as long as terminal segment. Length ratio of three endopodal segments 2.80:1.00:1.40.

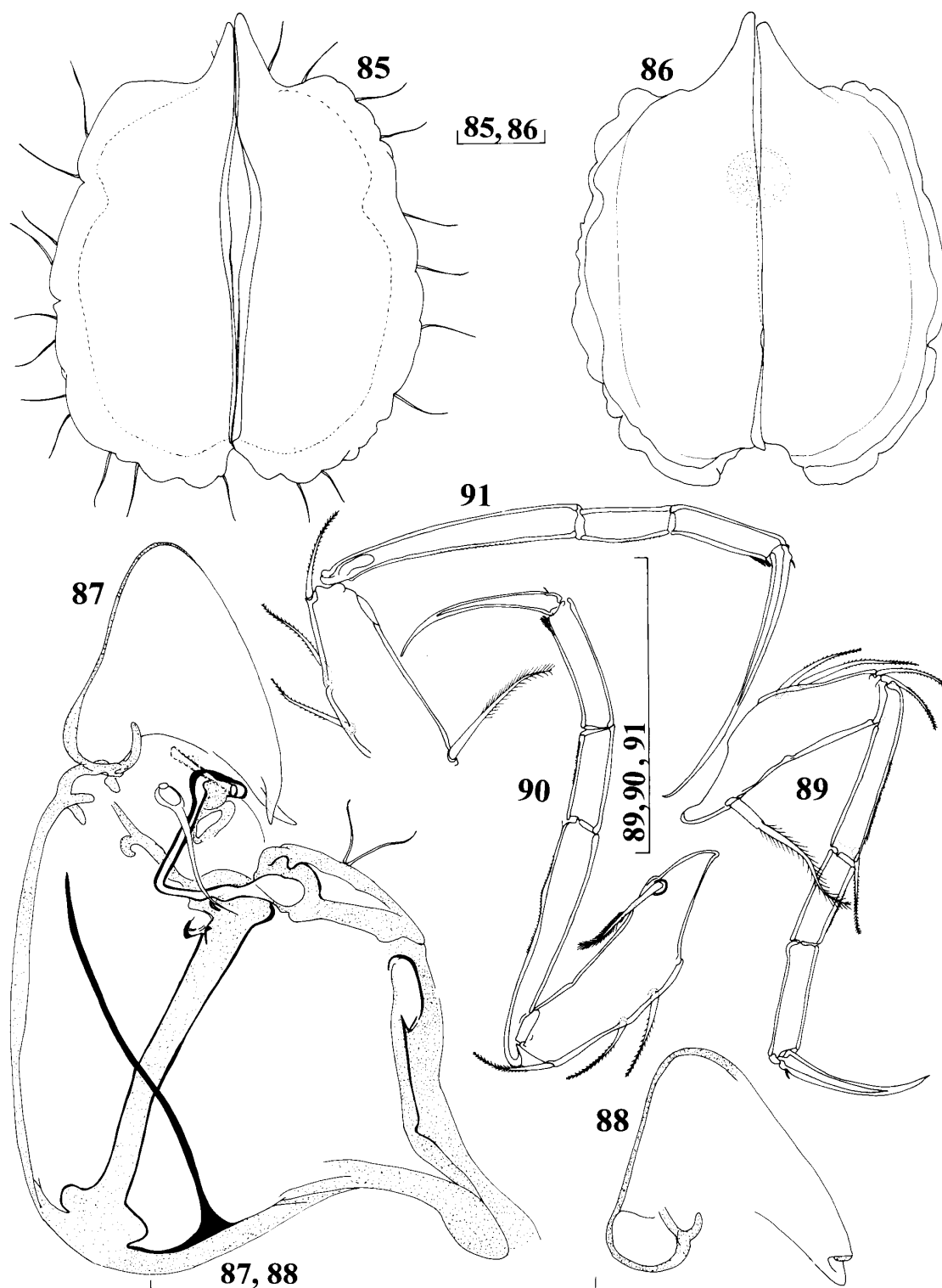
Third walking leg (Fig. 91) with protopodite armed anteriorly with one proximal seta, one medial seta, and one distal seta, all pappose, and with one pappose seta posteroproximally. First endopodal segment without any seta anterodistally. Terminal claw long and thin, 2.5 times longer than terminal segment, with small seta posterodistally on claw. Length ratio of three endopodal segments 2.80:1.00:1.20.

Posterior part of body (Fig. 83) with one long, robust seta proximally and two much shorter setae distally. Both furcae developed, each consisting of two hirsute furcal lobes and one thin furcal seta. Genital operculae simple.

Male (allotype). Length of carapace 0.500 mm. In dorsal and ventral views (Figs 85, 86), male similar to female, just slightly thinner. In lateral view, appearance same as in female.

Antennula with length ratio of four distal segments 4.70:1.80:1.00:4.20.

Antenna (Fig. 84) with pronounced anterior intrusion in chitin, opposite to



Figs 85–91. *Gomphodella yandii* sp. nov. 85–88, Allotype male (0.500 mm, WAM C33469); 89–91, holotype female (0.567 mm, WAM C33469). 85, Carapace, ventral view; 86, same, dorsal view; 87, hemipenis; 88, distal lobe of hemipenis; 89, first walking leg; 90, second walking leg; 91, third walking leg. Scales=0.1 mm.

posterior setae. Other appendages generally similar to those of female holotype.

Body of hemipenis (Figs 87, 88) not very muscular, but distal lobe prominent and articulated. Distal lobe triangular with blunt tip, dorsal margin almost straight, ventral margin without chitinous rim distally, but with triangular end, divided into two pointed tips. On main body upper ramus relatively long and slightly sinusoidal, not very well sclerotized. Copulatory process well sclerotized, long and distally curved.

Etymology. The species is named after the Yandi Station, where it was collected. It is a noun in the genitive case.

Distribution. Known only from the type locality.

Discussion

Gomphodella maia differs from the three new species by the prominent sexual dimorphism in carapace shape. It also has a posterior seta on the fourth segment of the antennula and three posteromedial setae on the third segment of the antenna. On the contrary, all the new species lack a posterior seta on the fourth antennular segment, have only two posteromedial setae on the third antennal segment, and show little sexual dimorphism in carapace shape. Among the new species, *Gomphodella yandii* is easily recognizable by its six-segmented antennula, reduced furcal lobes, elongate second segment of the antenna, and lack of setae on the second

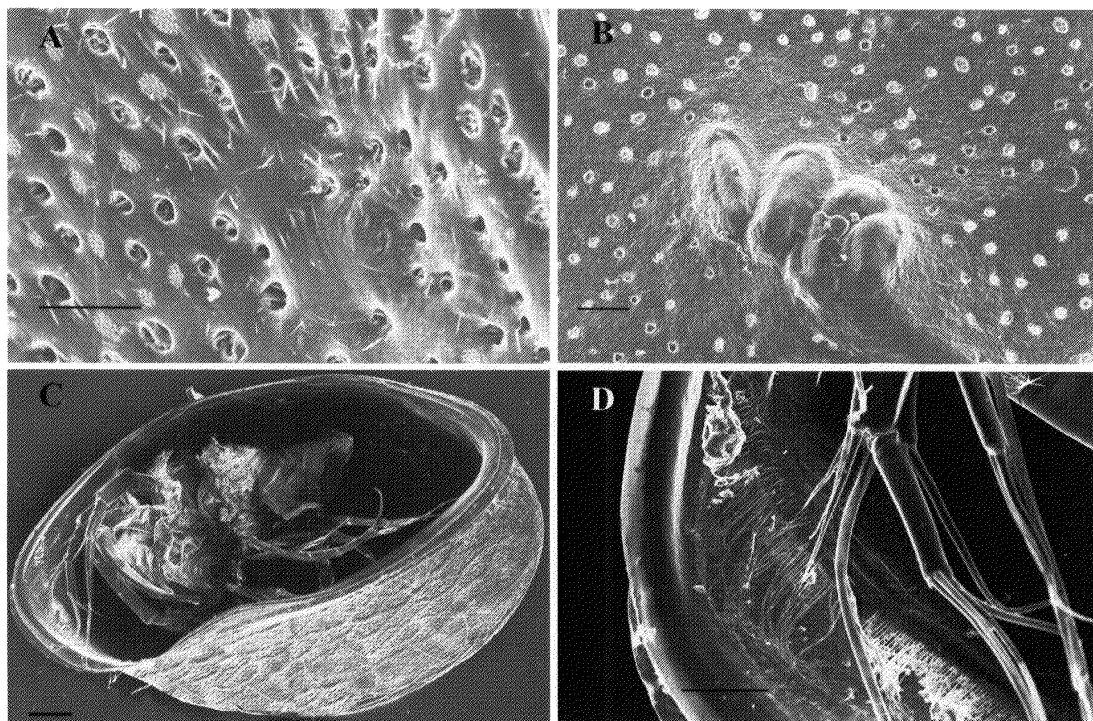


Fig. 92. SEM photographs. A, B, *Gomphodella maia* De Deckker, 1981; C, D, *Gomphodella glomerosa* sp. nov. A, Detail of surface and sieve pores; B, imprint of adductor muscle scars; C, right valve, oblique view; D, marginal pore canals. Scales: A=2 μ m; B=10 μ m; C=20 μ m; D=2 μ m.

endopodal segment of the second and third walking legs. *Gomphodella yandii*, just as *G. hirsuta*, has a squarish carapace in dorsal view. In *G. glomerosa*, the carapace has a ball-like appearance. All species of the genus *Gomphodella* can also be distinguished easily from each other by the shapes of the distal lobes of the hemipenes.

Gomphodella until now had only two species, *G. maia* and *G. australiaca* (Hussainy, 1969). The latter species was originally described in the genus *Gomphocythere*, but later on it was transferred to *Gomphodella* by De Deckker (1981a). His decision was based on the absence of lateral and ventral ridges on the flat base of the carapace. In this paper I am returning *Gomphodella australiaca* to the genus *Gomphocythere*, because the presence or absence of these ridges is a specific, not a generic feature (Klie 1939; Martens 1993). Furthermore, Hussainy's (1969) species has a posterior seta on the first endopodal segment of the antennula. The absence of a posterior seta on the first antennal segment, as found in all four *Gomphodella* species, is not recorded in any other genera of the Timiriaseviinae. The lateral position of that seta (versus apical in the subfamily Limnocytherinae) is considered to be a diagnostic feature of this subfamily (Martens 1995), along with the length of the terminal segment of the antennula. This segment is considerably longer than the penultimate one in the Limnocytherinae, but the same length or shorter than the latter in the Timiriaseviinae. *Gomphodella glomerosa*, *G. yandii*, and *G. maia* have the terminal segment longer than the penultimate one. Martens (1993, 1995) reported sexual dimorphism in the length ratio of these two segments in *Gomphocythere ortalii* Martens, 1993, but in this species the terminal segment is at most as long as the penultimate one. Another characteristic which easily distinguishes *Gomphodella* from the rest of the timiriaseviine genera is the form of the mandibular palp, in which the penultimate and terminal segments carry very characteristic claws. However, the palp is still four-segmented (as in *Gomphocythere*, *Kovalevskiella*, *Metacypris*, and *Elpidium*) in contrast to *Afrocythere* and *Cytheridella*, in which it is three-segmented (Daday 1905; Klie 1935).

All four species of *Gomphodella* possess both furcae, while one or even both furcae can be absent in some other genera of the subfamily. When the furcae are absent, a so-called "fork-like" organ is developed. This organ has been noticed by many authors (Klie 1939; Barklay 1968; Hussainy 1969; Rome 1970), and described by Rome and De Deckker (1977). Martens (1993, 1995) included the absence of one furca in the generic diagnosis of the genus *Gomphocythere*; this, however, demands a comment. Sars (1924) gave a diagnosis for the genus *Gomphocythere* and clearly stated that in females there are "two juxtaposed thin lamellae curving anteriorly, each terminating in a digitiform acutely pointed lappet, at the base of which, outside, a plumose seta is attached; posterior (dorsal) edge of each lamella divided into three successive short linguiform lobules clothed at the tip with long diverging cilia." On the other hand, in *Cytheridella* Daday, 1905, both furcae are transformed into fork-like organs, while whether this is so is not completely clear in *Afrocythere* (see Klie 1935, fig. 62).

Gomphodella is the third genus in the subfamily with developed sieve pores, and they are recorded for certain in three of four species. All Limnocytherinae have sieve pores, while in the Timiriaseviinae only species of the genera *Cytheridella* and *Gomphocythere* have such structures (Martens 1995). Reduced sieve pores are recorded in *Metacypris cordata* Brady and Robertson, 1870. Another feature common to all species of *Gomphodella* is the presence of a brood chamber

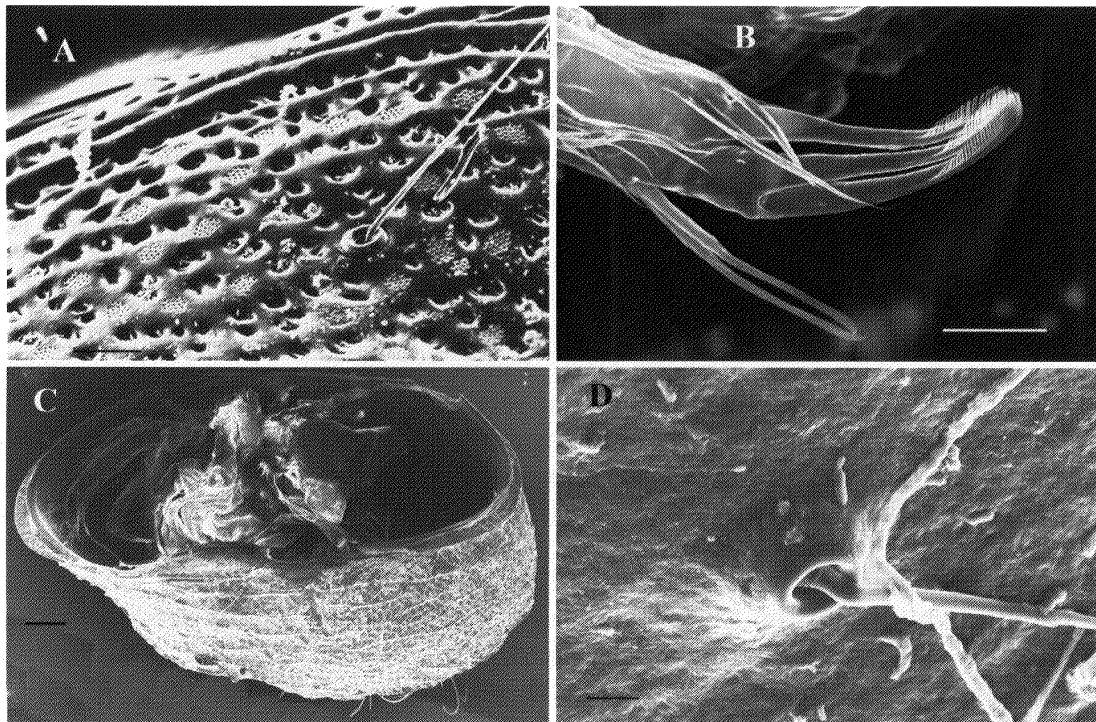


Fig. 93. SEM photographs. A, B, *Gomphodella maia* De Deckker, 1981; C, D, *Gomphodella hirsuta* sp. nov. A, Surface ornamentation and sieve pores; B, mandibular palp, detail; C, right valve, oblique view; D, detail of seta. Scales: A=2 μm ; B=10 μm ; C=20 μm ; D=10 μm .

in females. Colin and Danielopol (1980) and Martens (1995) considered it as a family feature, but the only species of *Afrocythere* does not possess such a chamber, and neither do some species of *Gomphocythere*, such as *G. ortalii* Martens, 1993.

In spite of the many dubious diagnostic features of the Timiriaseviinae, its representatives still have enough common features to be united in the same subfamily. As for fossils, the type of hinge (lophodont/inverse lophodont) combined with the presence of a brood chamber and one or two sulci on the carapace are diagnostic. The Recent species, besides having the same carapace features (except for brood chambers, see above), are all characterized by an incompletely segmented maxillular palp and a hemipenis with a movable distal lobe.

All new species of *Gomphodella* are found in subterranean waters of Western Australia, whereas live specimens of *G. maia* were collected in Dip Lake and Turners Spring. In the type locality of *G. maia*, salinity can reach 2.3‰. Empty valves of this species were also abundant in another two lakes in Australia. The Margaret River samples were collected in the benthos/interstitial (two samples) layer of the spring and the benthos/periphyton. The finding of the three new species may suggest that the genus has an evolutionary trend towards a subterranean way of life, as do the living species of *Kovalevskiella*, which are present only in the subterranean waters of Europe and Central Asia (Karanovic 2003a).

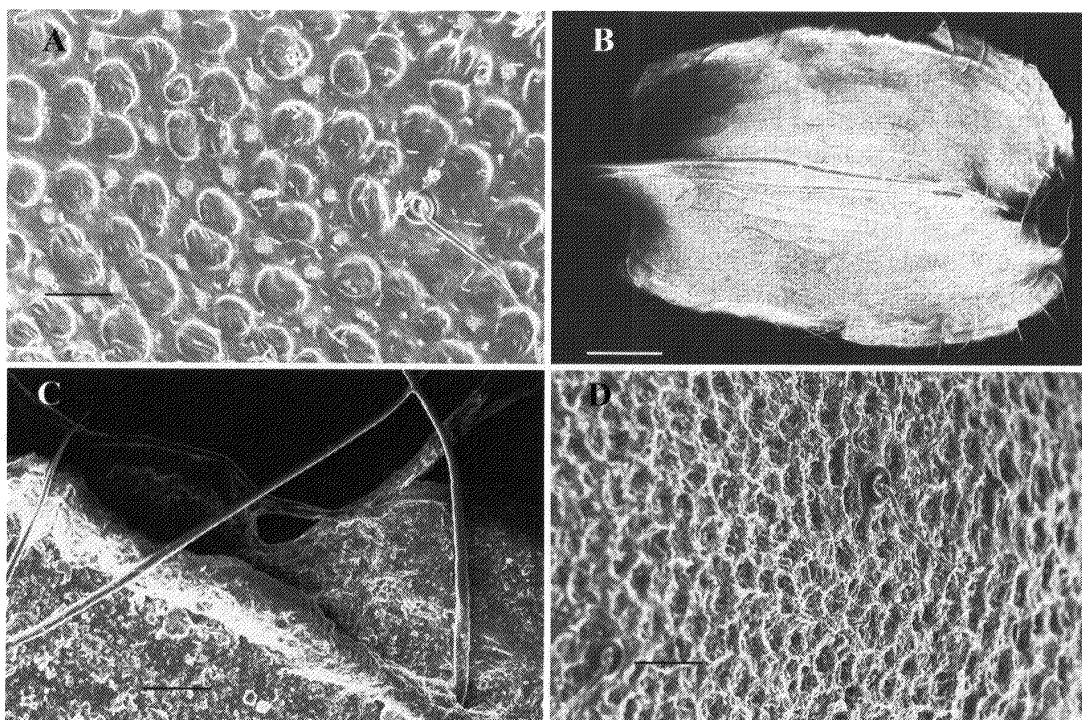


Fig. 94. SEM photographs. A, *Gomphodella hirsuta* sp. nov.; B–D *Gomphodella yandii* sp. nov. A, Detail of surface and sieve pores; B, carapace, ventral view; C, detail of wings; D, detail of dorsal ornamentation. Scales: A=10 μ m; B=100 μ m; C=10 μ m; D=10 μ m.

Key to the species of *Gomphodella*

1. Antennula with one posterior seta on fourth segment; antenna with two setae and aesthetasc posteromedially on third segment*G. maia* De Deckker, 1981
- Antennula with no posterior seta on fourth segment; antenna with one seta and aesthetasc posteromedially on third segment2
2. Furca with two lobes; antennula six-segmented; second and third walking legs with no seta on second endopodal segment*G. yandii* sp. nov.
- Furca with three lobes; antennula five-segmented; second and third walking legs with one seta each on second endopodal segment3
3. Carapace rounded in dorsal view*G. glomerosa* sp. nov.
- Carapace somewhat quadrangular in dorsal view*G. hirsuta* sp. nov.

Acknowledgements

I would like to thank Dr William Humphreys of the Western Australian Museum and Dr Stefan Eberhard of the Department of Conservation and Land Management, for entrusting me ostracod material that reviled the above species of the genus *Gomphodella*.

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